RAILROAD GAZETTE

FRIDAY, MARCH 17, 1893.

CONTENTS.

Contributions.

The Speed and Capacity of Rapid Transit Roads in Cities.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Feeling in some degree responsible for the discussion on the capacity of Rapid Transit roads which appeared in the *Railroad Gazette* on Dec. 30 and Jan. 20, for the reason that your correspondent "E. A. B.," who opened the discussion, had previously asked me a question which I did not answer to his satisfaction and had received from another source an answer differing extraordinarily from mine, I beg leave to contribute further to the discussion by presenting a diagram which presents the results of several thousand observations of the time of starting, stopping and running of Rapid Transit trains on the Manhattan Elevated and the New York Central surface roads in and near New York.

The interesting data published in *Railroad Gazette* of Jan. 20, 1893, regarding the work done by some locomotives in Chicago do not appear to me to represent the average capacity of any existing motor on any road in actual operation. They show undoubtedly what is possible under the conditions under which the experiments therein mentioned were made, but they do not show that an eight-car train can be run in urban rapid transit service with any such results as attaining an average of 28 miles an hour and carrying 32,000 passengers an hour. In one respect, at least, the formula given is, I think, incorrect. The distance in feet to reach the maximum speed of B miles per hour is given as $0.846\ B^2$. I think that investigation and experiment will show that the co-efficient cannot be a constant quantity but must be a variable, increasing with the value of B.

Without going further in the discussion of this question now, I wish to present for the consideration of your readers the following formula, which I have derived from reducing several thousand notes of speed, of starting, running and stopping trains from 200 to 300 ft. long drawn by steam motors weighing from 28 tons in urban, to 60 tons in suburban service, and capable of attaining aspeed of 60 miles an hour in regular urban and suburban rapid transit service.

The curve of acceleration shown in the diagram presented approaches a parabola and its equation is

$$t = n\sqrt{\left(1+\frac{d}{12{,}000}\right)d},$$

in which t = time in seconds required to travel d = distance in feet from a state of rest. For perfect track and operation the constant $n = 1.41$, and for the average daily and hourly operation of the road on which trains are run as frequently as is consistent with safety, $n = 1.55$. The notation on the diagram is in miles and minutes, but that can be easily reduced to feet and seconds.

The curve of travel shown on the diagram corresponds very closely with the formula, using the coefficient 1.41, and would correspond exactly if the curve had not been drawn before the formula was discovered.

In the diagram the stop at stations is made 30 seconds. This is double the average stop at stations on the Manhattan and the New York Central railroads during the greater portion of the day, but during the crowded hours of the day it sometimes occurs that a 30-second stop at a busy station is necessary. I think that in the operation of a long distance, rapid transit road, and particularly if it were to run trains more than 300 ft. long, 30-second stops would not be too great to allow for in arranging the time table. The time taken to travel a given distance cannot, in my opinion, with any motor, capable of attaining a speed of 60 miles an hour, and stations less than two miles apart, be much diminished in daily practice from what is shown on the diagram.

Now as to length of trains. For the sake of promoting discussion, I will assert what I believe to be absolutely true, and that is that trains of over 300 ft. in length are not desirable on a city transit road, whether the stations are one-quarter of a mile or two miles apart, and that the delays consequent upon their operation would be sufficient to reduce the average speed between terminals 8 or 10 miles apart so far below what is practicable with 300-ft. trains as to make their carrying capacity actually less.

I would like to hear from the advocates of trains 400 and 500 ft. long, making 40 miles an hour between terminals, some proof that something like what they want to do has been done anywhere, day in and day out, on an urban transit road. J. JAMES R. CROES.

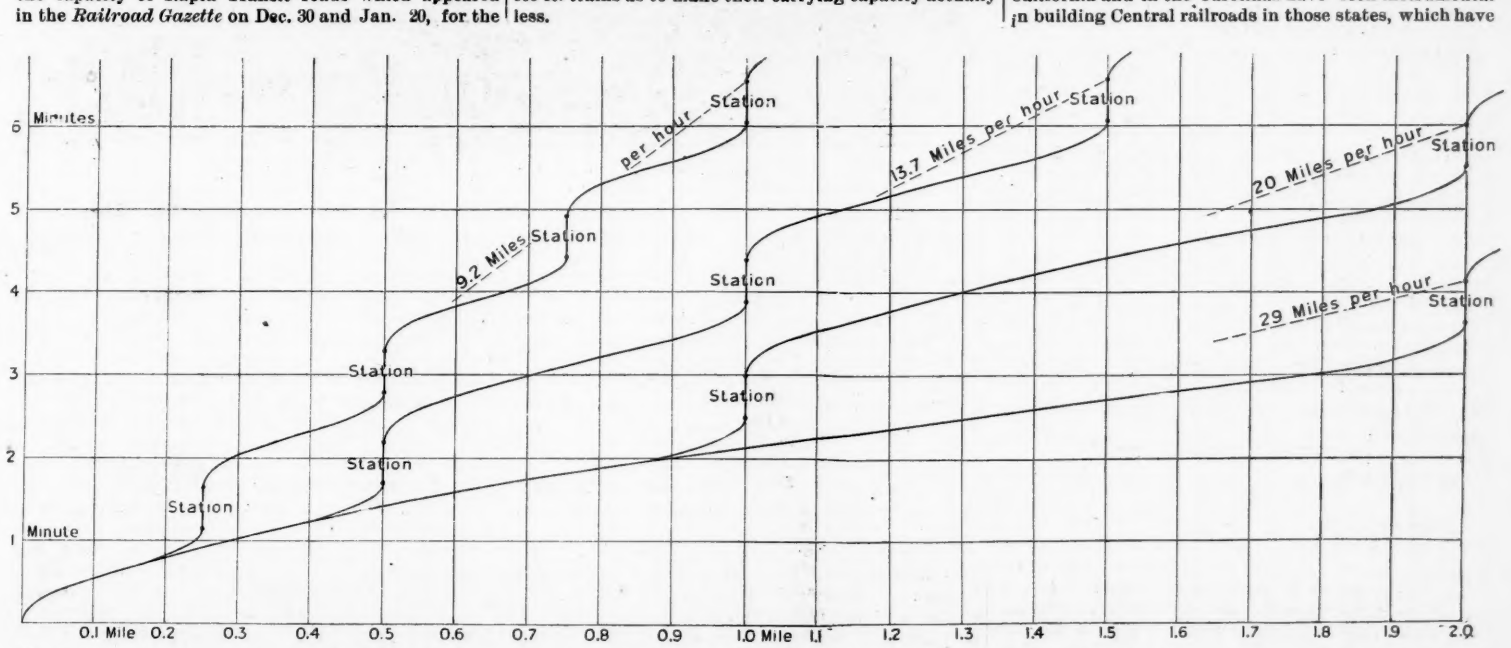


Diagram to Accompany Mr. Croes' Communication on Speed and Capacity of Rapid Transit Roads.

Tapping Car Wheels for Cracks.

INDIANAPOLIS, Feb. 27, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in your valuable paper, issue of Feb. 24, certain statements concerning the tapping of wheels. In 1842, shortly after Oliver H. Lee, Chief Engineer of the then Syracuse & Utica Railroad, left, the Master Mechanic, David H. Beggs, of Syracuse, made it imperative to test, with the hammer, all wheels at the passenger depot in Syracuse, N. Y., on Salina street and Washington. The person employed was named Norman Vosburg. The wheels run at that time (being under four-wheel coaches, three compartments, lettered in alphabetical order for seats), were spoke, three openings in the centre, filled with zinc, and then banded, driven on and keyed to the axles. Shortly after, the Bush & Lobdell wheel, of Wilmington, Del., came into existence, double plated and crowned, and with these wheels the axle was pressed in with a 3-in. screw, geared and worked by hand levers. WALTER S. PHELPS.

The Chicago & St. Louis Electric Railroad.

PHILADELPHIA, March 14, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It would add to the strength of your editorial criticism on the above subject if you would state, what I believe to be the truth, that neither the engineering plans nor the estimated financial returns from the proposed enterprise have received the indorsement of any practical electrical engineer or reputable electrical journal. At the same time there has been no disposition to assert that a speed of 100 miles an hour cannot be attained. The whole affair bears the earmarks of a gigantic scheme to delude the public, of which the surveys made and grading actually done are of no more practical bearing than the work already performed on the Panama Canal. As has frequently been the case, general ignorance of electricity is simply depended upon to furnish innocent victims, and the judicious placing of advertisements has probably silenced the criticisms of the daily press. ELECTRICIAN.

The C. C. & C. C.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I regret to see that your valuable countenance should be given to the proposal of naming any line the Cape Cod & Cos Cob Railroad. It is quite possible that in calling the name artistically perfect you are correct, but in making the statement did it occur to you what woes would be inflicted upon the car accountants and clerks of this country by the addition of another "C" road?

It has long been known that the record book containing the "C" cars has been the hardest to keep straight in the car accountant's office, and the blame for this has been laid largely upon the sponsors for the cities of Chicago, Cleveland, Columbus and Cincinnati, between which people have had an unfortunate propensity for building railroads. Our difficulties were intensified by the existence of a town named Canton in Ohio, which turns up in railroad names when you would least expect it, and the projectors of lines from Charleston and Columbia to Cincinnati and other "C" points have introduced us to cars and roads which it is frequently difficult to locate. Other parties resident in Colorado, in California and in the Carolinas have been instrumental in building Central railroads in those states, which have added to the general ill feeling. More recently certain inconsiderate persons in the Central part of Pennsylvania have built a great many short railroads connecting Cresson, and Clearfield and Cambria Counties; and a great gloom fell over the country when Mr. Crocker, who had a Chair company, built cars and lettered them with three "C's," and the same thing was done by the Calumet Canning Company and the Connellsville Coke Company. We thought that the last straw had been laid on our backs when Mr. Canda insisted on putting four "C's" on his Canda Cattle Car Company cars, but now if we are to have all the Consolidated Railroad's cars marked C. C. & C. C. I think we shall have to give up our jobs. C. A.

[We give in. We are now in favor of "New York & Old Colony," and shall remain so—until the next issue.—EDITOR RAILROAD GAZETTE.]

Junction Reports Again.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice that Sechrist's *Railway Equipment Guide* for February copies your editorial of Dec. 16 proposing a check on junction reports, and also my letter comment-

ing thereon published in your issue of Dec. 23. In noticing these articles, the *Guide*, although it approves of your suggestion of numbering junction reports consecutively and copying them in an impression book, goes on to urge the adoption of what is known as the Tiffany plan for making junction reports.

Mr. Tiffany's plan contemplates having these junction reports made direct from the agent at junction points to the owners of the cars, but it would seem that a plan of this kind would render absolutely impracticable the check on junction cards which you propose and the *Guide* indorses.

There must be many thousands of junction points in the country, and for a railroad to check up the junction reports received from all these points would seem to be an endless task. Conversely there are several hundred railroads, and for each junction agent to keep a check on all the reports which he has sent to them would seem to be equally impossible. I called attention to the difficulty in obtaining a reliable report of interchanges from junction points at which there is no regular agent of the railroad company, and from the "industrial" companies whose works are connected with two railroads, and which are likely to load out over one railroad cars received from another. If it is difficult for the home office now to make a reliable junction report covering interchanges at such points, it would seem impossible to make the Tiffany plan cover such interchanges. A system similar to the Tiffany scheme was tried a number of years ago in the West, where it was given up as a failure. Since it again came to light under Mr. Tiffany's sponsorship it has not been put into effect by any of the railroads.

The Old Colony road has, however, adopted a scheme of its own covering some of its larger junction points which, in some respects, is similar to the Tiffany scheme. The agent at each junction point makes out his interchange report to the home office in duplicate, using carbon paper, and classifies the cars on his report by ownership. When the duplicate reports are received in the home office the original is at once sent to the record and the duplicate is cut up and sent to the owners of the cars concerned. The reports thus sent out are on red paper, which is pretty hard on the eyes at night. As the report is duplicated by the carbon process, the paper is very thin and is not nearly so easy to handle as the ordinary junction report. The reports are of a uniform width of about six inches, but they vary in length; some of them are only about an inch long and others may be four or five inches, according to the number of cars interchanged on the date in question. On this account they are very inconvenient to handle and to file. I understand that these reports are reaching the offices of the railroads whose headquarters are in Boston about four days after the interchanges are made, so that it would seem that not much time is saved by this process. If the Tiffany scheme does not result in greater promptness in transmission of junction reports it would seem to have no advantages and all the disadvantages resulting from the use of a report of irregular size on flimsy paper in whose transmission there seems to be a considerable amount of "lost motion."

The *Guide's* article ends by recommending that the interchange report be sent to the home office by wire in order to secure the sending to the owners of the cars a report on the date after delivery. If you are going to this expense why not extend the plan for roads whose headquarters are at a distance by making a telegraphic junction report? This would give all roads the location of their cars much more promptly than any of the present methods. C. D. E.

The Rogers Compound Locomotive on the Illinois Central.

The two-cylinder compound locomotive of the mogul type built some months ago for the Illinois Central Railroad, after the designs of Mr. Reuben Wells, of the Rogers Locomotive & Machine Works, has been in constant use in freight service ever since its arrival in Chicago, with very satisfactory results. This is the first compound built by the Rogers works, and is one of an order for 25 engines, of which the remaining 24 are single expansion engines. The following are some of the principal dimensions of this locomotive:

Diameter of H. P. cylinder	20 in.
Diameter of L. P. cylinder	29 in.
Outside lap of H. P. valve	1 in.
Outside lap of L. P. valve	⅞ in.
Inside lap of H. P. valve	0 in.
Inside lap of L. P. valve	0 in.
Maximum valve travel H. P. Cylinder	5⅛ in.
Maximum valve travel L. P. cylinder	6 in.
Diameter of drivers	56½ in.
Weight on drivers	107,300 lbs.
Weight on leading truck	21,200 lbs.
Tender capacity	3,500 gals.
Rigid wheel base	14 ft.
Engine wheel base	21 ft. 8 in.
Total wheel base	45 ft. 10 in.
Type of boiler	Belpaire
Diameter of flues	2 in.
Length of flues	11 ft.
Size of firebox	33 in. × 111 in.

The engine is equipped with two "Monitor" injectors and a Nathan improved sight feed lubricator. The leading truck wheels are 33 in. in diameter, with cast-iron centres and Krupp steel tires. The tender truck wheels are Washburn double plate wheels 36 in. in diameter; axles and boxes, M. C. B. standard.

The tender trucks are equipped with the Westinghouse automatic quick-acting air brake, and the drivers with the American outside equalized brake, operated on the Westinghouse system.

This engine differs from the single expansion engines only in the matter of cylinders, intercepting valve, and link motion. The size of the cylinders of the simple engines is 19 × 26 in.

The details of some of the most interesting features of this compound are shown in the accompanying illustrations.

The intercepting and reducing valves are shown in detail in fig. 8. The reducing valve projects out from the top of the smoke-box, though not so much as shown, and consists of a valve *B* and piston *A*, mounted on a stem *F*, in an iron chamber *J*, the space between the valve and piston being filled by steam supplied from the live steam pipe through a 2¼ in. connection. The net area of the upper side of the piston *B* is 7.69 in., while that of the under side of piston *A* is 3.37 in. The chamber *D*, above piston *A*, opens to the atmosphere through port *E*, so that any leakage past the piston will not interfere with the free action of the valve. Neglecting friction, the valve will open when the pressure beneath the valve drops below 56 per cent. of the live steam pressure in the valve chamber, thus admitting live steam to the passage, which leads to the intercepting valve shown below.

So far as the operation of this valve is concerned, it will open at any time when the pressure beneath the valve falls below 56 per cent. of the pressure in chamber *J*. The opening of this reducing valve is, however, controlled by the position of the reverse lever, the arrangement being such that the reducing valve can open only when the reverse lever is in the extreme backward or forward gear. Referring to fig. 8, it will be seen that the upper end of the stem *F* of the reducing valve is slotted to receive the short arm *G*. This arm is mounted on a short shaft, to which is keyed a longer arm *H*, the end of which drops nearly to the centre of the smoke-box. Attached to this arm will be seen on fig. 1 a rod leading back to the mechanism just in front of the air pump. This device is actuated by an independent reach rod from the reverse lever. The shape of the curved slot on this mechanism *M* is such that when in mid-gear the arm *G* lifts on the valve stem *F* of the reducing valve with such force as to prevent its opening, but when in extreme forward or backward gear the arm *G* drops to such a position as to allow the valve to open or remain closed, according to the pressure in and below the valve. (This reducing valve was designed about two years before the Westinghouse air brake was brought out, for the improvement of the action of a chain brake which was being used on the Jeffersonville Railroad.

Referring again to fig. 8, it will be seen that the steam, after passing through the reducing valve, flows through the 2-in. pipe to the intercepting valve. The valve proper consists of a plain flap valve which closes diagonally across the receiver pipe in such a way as to prevent the steam admitted to the low pressure cylinder from backing up against the high pressure piston and reducing its power. This flap valve is connected to a hollow piston *T* by means of the link *U*. Assuming that the parts are in the position shown and that steam is admitted through the pipe *L*, is will press upon the end area of the piston and force it out, thus closing the intercepting valve. When this is accomplished, the ports *V* are uncovered and the steam flows directly to the low pressure cylinder.

Leakage holes *X*, *X* are provided to permit any steam remaining in the reducing valve to pass out when the valve is pushed back until the opening *V* comes opposite the opening *Z*, thus permitting the steam remaining in the piston and passages to pass out. When in the position shown in the engraving, there is a ¾-in. leakage hole open from the hollow of the piston out through *Z* to *X*. There is also a ⅝-in. hole to the space *W* to prevent slight changes in pressure between the different chambers and pipes from unnecessarily moving the piston and intercepting valve. The air or steam in the space *W*, around the piston *T*, provides a cushion between the collar of the piston and the adjustment ring *Y* and protects the intercepting valve from shocks in seating itself. The bearing at the hinges of the intercepting valve is made loose enough at *R* to insure the seating of the valve.

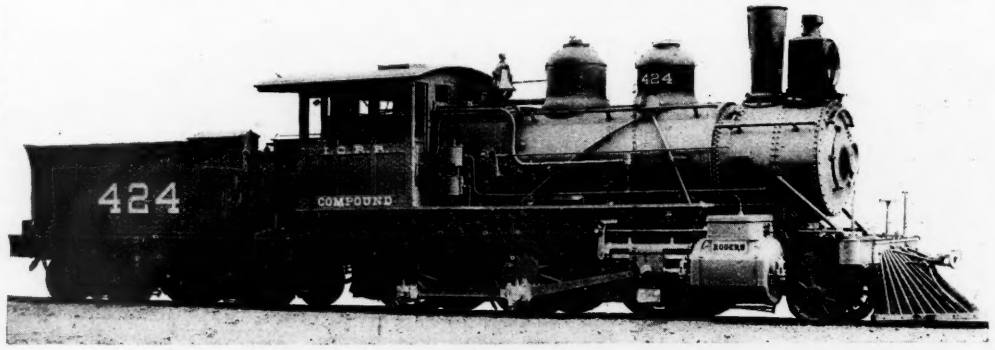
The intercepting valve *O* and piston *T* are made of cast steel.

Referring to other drawings shown, the number of interesting features in the design of this engine will be noted. It will be seen by reference to figs. 6 and 7 that steam is supplied to the high-pressure cylinder through an opening near the back of the saddle casting and at the rear of the exhaust opening, and that to reach the head end of the cylinder a passage *A A* is provided, leading around the exhaust passage. The clearance of the high-pressure cylinder amounts to about 15 per cent. of the piston displacement, and is made up partly in the length of steam ports and unusual height of valve seat, figs. 4 and 6, and partly in the shape of the cylinder head, fig. 5, which is dished about 1½ in. for the purpose of gaining additional clearance. This cylinder-head is ⅞ in. in thickness and strongly trussed with radial ribs. The design of the low-pressure cylinder-head seems comparatively light, the metal being somewhat thinner than is generally used for heads of this size, but well trussed by deep ribs, of H section. Unfortunately the tensile strain comes on the smaller section of the head.

The low-pressure link hanger is a ¼ in. longer than the high-pressure hanger, thus providing a later cut-off in the low-pressure cylinder while in forward gear. This difference in cut-off amounts to ⅛ in. in full forward gear, and 1¾ in. in the first notch. In the backward gear this relation is reversed, the cut-off in the low-pressure cylinder being about as much earlier than the high-pressure as it is later in forward gear.

Fig. 3 is a section through the cab and firebox, and fig. 2 a sectional elevation, showing the location of the link-work and the appearance of the reducing valve and receiver in the smokebox.

The continued use of this compound in regular service and on the pooling system, which gives it to different engineers almost daily, speaks well for its simplicity and practicability. Accurate tests of this engine are in progress, and the result will be given in due time.



Rogers Compound Locomotive on the Illinois Central Railroad.

The Electric Convention at St. Louis.

The sixteenth convention of the National Electric Light Association which has just closed its sessions at St. Louis has again demonstrated how very small a proportion the use of electricity for lighting bears already to its use for other purposes; and also shows that the name of the Association is quite too limited to convey an idea of the importance of its papers and discussions, which are, many of them, filled with matters of general engineering interest, although not more related to lighting than to any other use of the energy derived from the combustion of coal or from falling water.

The incandescent lamp came in for mathematical treatment from a commercial standpoint, in which it was shown that if the stopper lamp would give more light for a given expenditure of power, it could be renewed oftener than the others and cost less in the end, which seemed to be good news until a practical man wanted to know if we might expect such a lamp soon, and if it will be generally supplied to those who want to use it. The reply was: "They are being made and supplied every day." Subsequent remarks revealed a very bitter feeling on the part of central station managers (or some of them) toward the lamp monopoly; but the flame which was about to burst forth was judiciously smothered by the President, who said that the Committee on "Relation of Manufacturing to Central Station Interests" could be relied upon to attend to all grievances of this kind.

In his official address the retiring President had called upon the Association to take action looking toward an amendment of the patent laws, by which the present threatened losses to lighting companies and patentees may be avoided in future, by an earlier affirmation on the part of the Patent Office and of the courts of the rights of an inventor. No indication was given of how this desirable end might be accomplished, and no action upon the suggestion was taken by the Convention. It would have been judicious to appoint a committee to ascertain whether any one sees clearly or not how it can be done; society is ready for it.

A committee reported upon the use of electricity at the World's Fair at Chicago, showing that the aggregate electrical horse-power now arranged for is 19,500, which may be compared with the totals of 4,000 H. P. at the last Paris Exposition.

There were three good papers upon long-distance transmission of power, which, however, contribute nothing to previous knowledge of the subject. It was again shown that by the aid of the transformer the highest possible economy in wire for transmission can be attained and that the current may be converted and reconverted at will, to adapt it to any use for which it

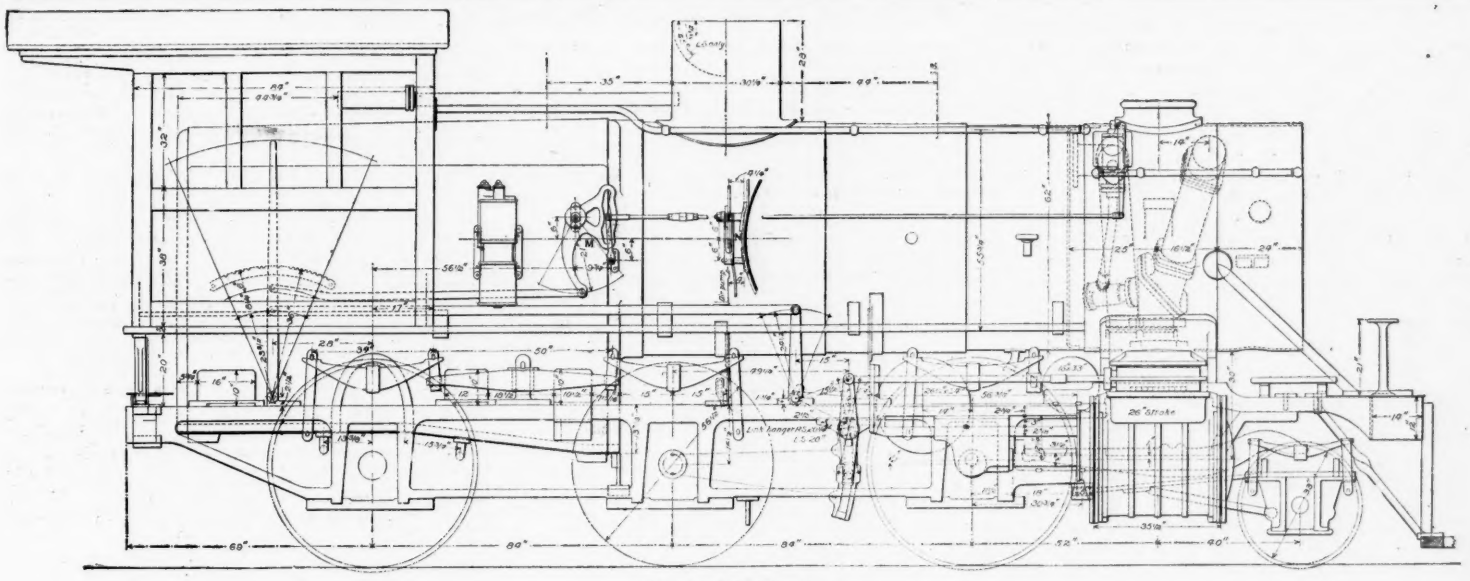


Fig. 1—Side Elevation.

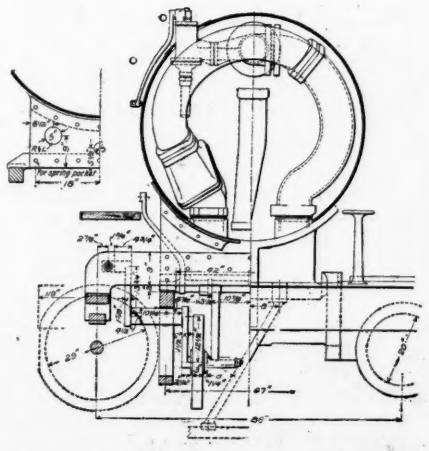


Fig. 2—Front End Elevation Showing Receiver.

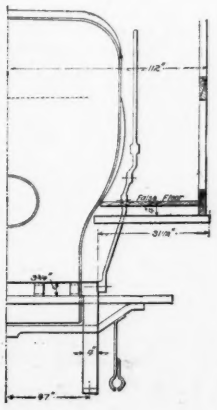


Fig. 3—Back End Elevation Showing Tail Frame.

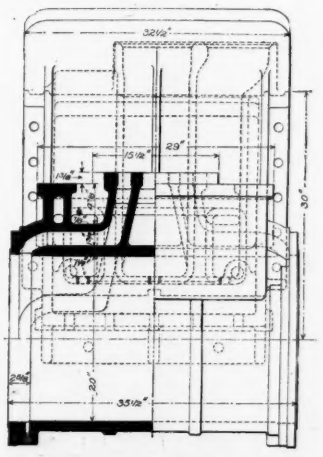


Fig. 4—Section of High-Pressure Cylinder.

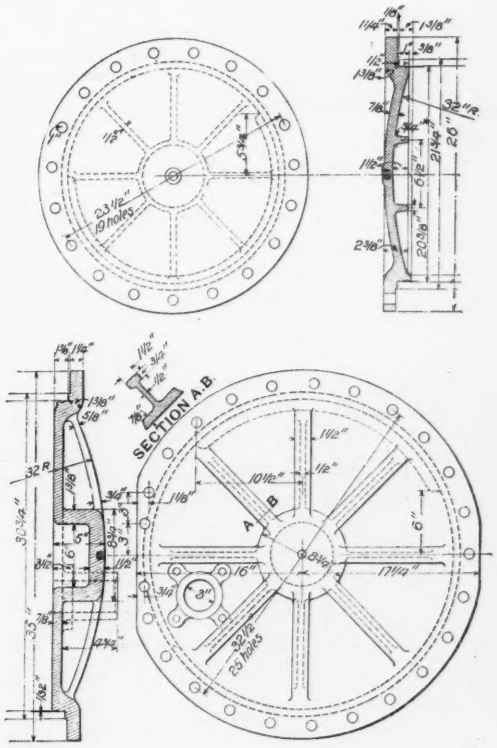


Fig. 5—Cylinder Heads.

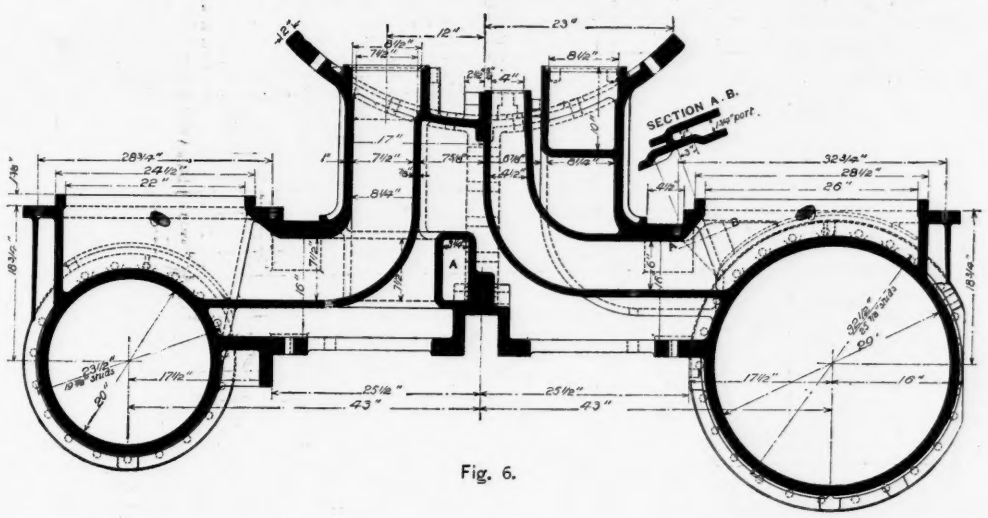


Fig. 6.

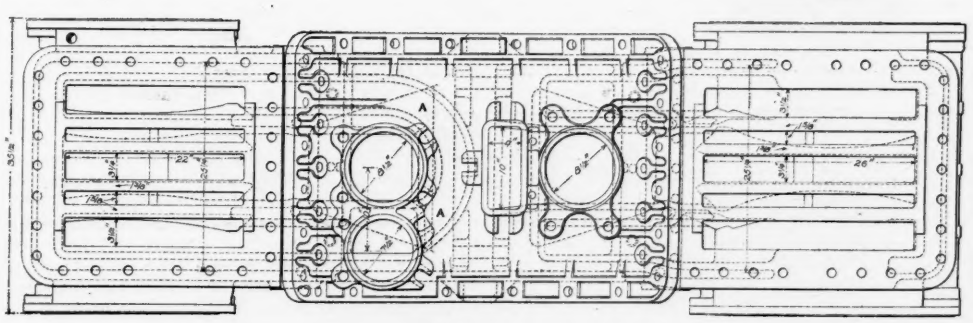


Fig. 7—Cylinder and Saddle Castings.

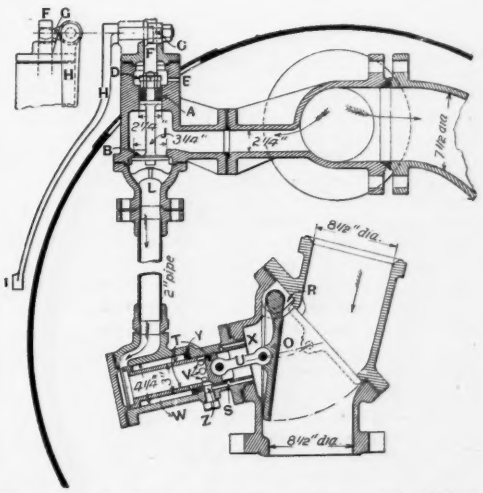


Fig. 8—Section Showing Reducing and Intercepting Valves

ROGERS COMPOUND LOCOMOTIVE ON THE ILLINOIS CENTRAL RAILROAD.

may be required at the point where it may be delivered.

The Lauffen-Frankfort still stands as the most conspicious example of what may be done in this way,—but the Convention had the satisfaction of hearing from Mr. Nunn, of the very complete success of his installation at Telluride, Col.,* of an alternating current derived from a stream 10,000 ft. above the sea, operating a synchronous motor 12,000 ft. above the sea, managed by miners who never saw an electrical apparatus except this one, which has made one continuous run of forty-five days, without stopping. This motor is of 250 H. P. and has been at work 18 months. So it appears to be satisfactorily demonstrated that if we cannot have, and may never attain to, a single-phase alternating motor, we are yet very well provided with means for long-distance transmission and for every day work. Yet the electrical engineers and inventors are confident that we shall have a powerful single-phase motor, give them time enough.

The experience in New York City with underground conduits and conductors was succinctly told by Mr. Wm. A. Browne. He shows that if the electrical companies had acted in harmony with the city authorities, instead of in opposition to them, about one-third of the present number of ducts would have been built, since only that proportion of those built are now in use; only one-quarter of the expenditures actually made

* See *Railroad Gazette*, March 3, p. 173.

would have been incurred and all the losses of the lighting companies on account of the destruction of poles and interruptions of business might have been avoided. Despite the statements of the electrical experts that the high tension circuits could not be operated underground, there were in 1892, 759 miles of cables in the conduits, upon which there were only 38 faults discovered during the year, many of which were found in new cables and due to imperfect work in laying. There are 131 circuits in the conduits, of which only 25 were interrupted by any fault. Mr. Browne's paper ought to be sent to all central station managers and promoters, as a kindergarten object lesson, to teach them not to set their shoulders against the chariot of progress when it is in motion.

Tests of Locomotives in Heavy Express Service.*

The demands of railroad passenger service on the locomotive have increased as fast as they are met by more powerful machines, until we have now about reached a point where little increase in locomotive capacity can be made without exceeding the maximum allowable weight on average main line track.

Eight years ago the principal passenger train west on the C., B. & Q., train No. 1, was hauled by 17×24 or 18×24 eight-wheeled, American type locomotives, weighing 82,000 lbs.; weight on drivers, 54,000 lbs.; total weight of engine and tender ready for service, 144,000 lbs., or 72 tons. The train was composed of 12 or 13 cars made up of coaches weighing from 48,000 to 50,000 lbs.; dining cars, 70,000 to 75,000 lbs., and Pullman cars from 65,000 to 75,000 lbs.; the total weight of the train being about 360 tons, and the engine and tender 72 tons; ratio 5 to 1. The time, Chicago to Galesburg, 162.5 miles, was 4 hours and 45 minutes; average, including stops, 36.3 miles per hour. The weight of cars has gradually increased, and instead of coaches we have chair cars weighing 66,000 lbs.; the dining cars now weigh over 95,000 lbs., and the Pullman cars 100,000 lbs. The total weight of a 10-car train is about 348 tons, and a 12-car train 400 tons. The schedule time is now reduced to 4 hours 2 minutes, and the average speed including stops is 40.0 miles per hour; exclusive of stops, the running time is 43 miles an hour. The type of engine now used in this service is the class "H" mogul, weight on drivers 94,500 lbs., *mean running weight* of engine and tender 164,500 lbs., the ratio of weight of cars to mean running weight of "H" engine is 4.2:1.

The total weight of the class "H" engine is: Engine, 113,000 lbs.; loaded tender, 74,000 lbs.; total, 187,000 lbs., or 93½ tons. The weight of its train of 10 cars averages 348 tons, ratio 3.7 : 1.

Reasoning from past experience we anticipated a further demand for more power in a single locomotive to haul more cars on the same fast schedule of train No. 1; and, when the Baldwin Compound No. 82 was sent to the C., B. & Q. R. R. for tests, we decided that the best use to be made of such an engine (with greater weight on drivers, larger boiler, cylinders and wheels than those of our largest passenger engines) was to test it on train No. 1 with a load proportioned to its greater weight. The 12 and 13 car tests were made at the request of the Baldwin Co.

The total weight of the Baldwin Compound No. 82 is: Engine, 68.4 tons; loaded tender, 40.6 tons; total, 109 tons. The weight of its train of 12 cars is 387.5 tons; the ratio of the weight of cars to total weight of engine, 3.55 : 1. The mean running weight of the Baldwin engine is 98.5 tons, and the ratio to weight of train is 4.03 to 1, or no greater in proportion to either its total or mean running weight than that given to the class "H" engines. The weight of cars for the two classes of engines is also very nearly proportional to the respective weights on drivers.

A diagram of the 8-wheel engine in general use in passenger service in 1885, and up to 1888, is shown in fig. 1; the class "H" Mogul is shown in fig. 2; class "M" 8-wheel engine, fig. 3, and the Baldwin Compound in fig. 4. The C., B. & Q. Compound is similar in general design to the simple class "H" engine, but the weight is somewhat greater; the weight on drivers, 97,000 lbs., and the total weight, 115,000 lbs.

Table No. 1 gives a further description of the different engines tested.

TABLE NO. 1.—DESCRIPTIVE TABLE OF ENGINES.

	Engine No.	Heating surface, sq. ft. Tubes.	Firebox.	Total.	Grate surface, sq. ft.	Mean running wt., e. & t.	Weight on drivers.	Diam. drivers, over all.	Exhaust nozzles.	Cylinders, inches.
Baldwin.....	82	1,966	169	2,135	28.3	197,100	103,000	72	5¼	4 / 14½ × 21
H comp	324	1,380	126	1.506	27.1	172,900	98,000	62	5	2 / 16⅜ × 24
H.....	150	1,380	126	1,506	27.1	164,500	94,500	62	5	19 × 24
H	145	1,380	126	1,506	27 1	164.500	94,500	68	5	19 × 24
M.....	617	1,301	111	1,412	24.5	151,500	66,000	68⅞	4¾	18 × 24

Maximum valve travel, engine No. 617, 6 in.; all the other C., B. & Q. engines, 5 in.
No. 82.....4-cylinder Vauclain Compound, 10-wheel.
No. 324.....2-cylinder C., B. & Q. Compound.
Nos. 150, 145..2-cylinder C., B. & Q. Moguls.
No. 617.....2-cylinder C., B. & Q. American type, 8-wheel.

These engines of different classes are not alike in weight, capacity, boilers, cylinders, etc., and our tests do not show the comparative value of simple and compound locomotives, but indicate the value of the Baldwin Compound engine No. 82 as compared with the standard C., B. & Q. locomotives for heavy express passenger service.

The whole work was in charge of our Engineer of Tests, Mr. C. H. Quereau, and I am indebted to him for the principal figures and calculations here given.

The same engineer ran all the C., B. & Q. test engines, and the Baldwin engine was always in charge of their engineer.

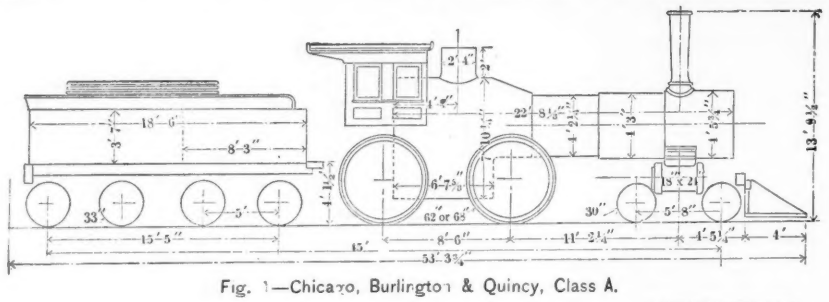


Fig. 1—Chicago, Burlington & Quincy, Class A.

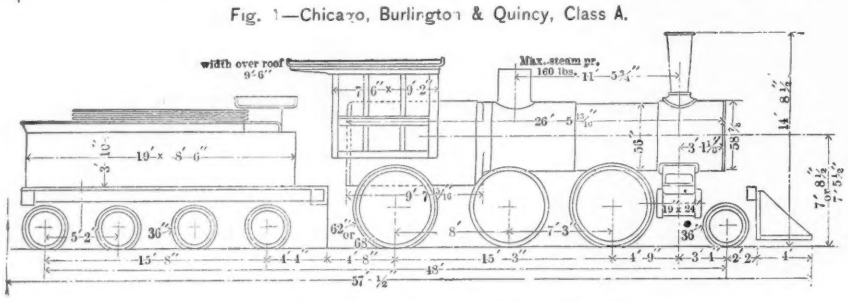


Fig. 2—Chicago, Burlington & Quincy, Class H.

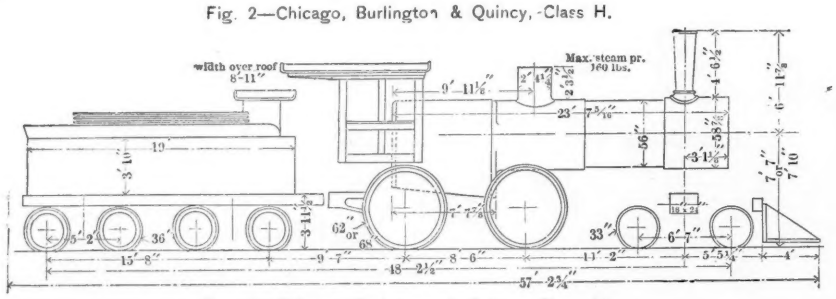


Fig. 3—Chicago, Burlington & Quincy, Class M.

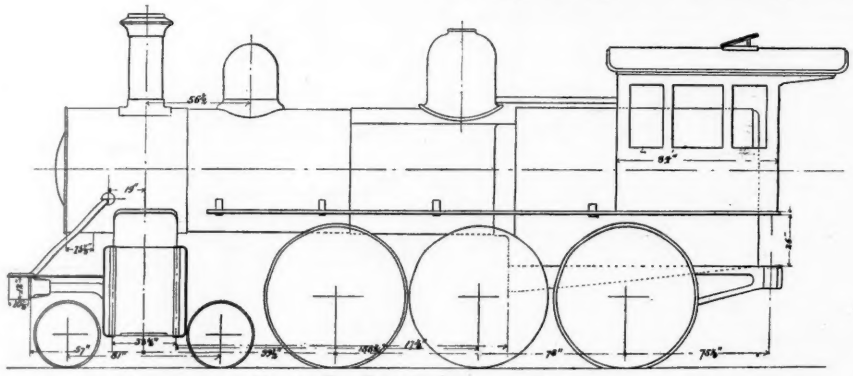


Fig. 4—The Baldwin Compound No. 82.

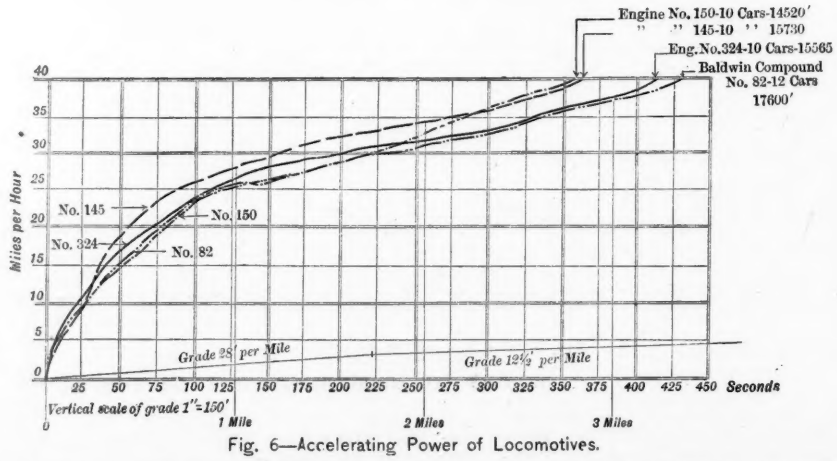


Fig. 6—Accelerating Power of Locomotives.

The value of the vulcanizing process in preserving wood, especially for crossarms, poles, etc., was shown by statistics of tests; the increase in strength amounting to about 18 per cent. and of stiffness to about 13 per cent; the increase of durability in the ground has not been determined for want of time. Samples of large timber, treated and untreated, exposed alike to influences of decay, showed that the untreated perished in five years and the treated timbers are still good and in use after ten years. The process of vulcanizing has already been described in the *Railroad Gazette*, especially in the issue of Sept. 5, 1890. It consists in exposing the wood to a temperature between 300 and 500 deg. F., under a pressure of 150 to 200 lbs. to the square inch. The electrical resistance of the wood is also largely increased by this process.

Prof. George Forbes, of London, who attracted much notice last year by his plan for the utilization of the rubbish of cities to replace coal in the production of electric light, stated in answer to a question, that the experiments in London showed that with the furnaces or "utilizers" now in use six pounds of rubbish as it is collected will equal in value as fuel one pound of coal. Professor Forbes also read to the Convention one of the most suggestive of all the papers which came before it (which we print *in extenso* elsewhere), because of its importance to all steam users, entitled "Thermal Storage for Central Stations." If the storage is a good thing for central stations, it will be applicable to countless other uses of power.

In a somewhat long paper, Captain Brophy pointed out the underwriter's way of building a station which will be secure against fire, and gave the members of the Convention the assurance that if they built and managed according to his suggestions they need not fear that the insurance agent would neglect their properties.

The newly elected President of the Association then took the desk and brought the proceedings to a close, with a plea for the application of the Golden Rule to the affairs of electrical companies; indeed, he included all corporations in his advice, and it is hoped they will apply it, "so far as practicable," as the old lady remarked.

Railroads in France.

The new lines of railroad to be opened for operation in France in the year 1894 amount to the immense aggregate of 383 kilometres, say 237 miles. Of this new mileage the Northern has 63 kilometres, the Eastern 75, the Western 35, the Paris, Lyons & Mediterranean 93, the Orleans 87, the Southern 6, and the State system 24 kilometres.

* Paper read by William Forsyth, Mechanical Engineer Chicago, Burlington & Quincy, at the February meeting of the Western Railroad Club, Chicago.

TABLE NO. 9. GENERAL AVERAGE RESULTS.

ENGINE. Class.	No.	ENGINE PERFORMANCE. Consumption per dyna. H. P. per hour, cars only. Coal.		Water.		Consumption per dyna. H. P. per hour, cars and engines. Coal.		Water.		BOILER PERFORMANCE. Evaporation from and at 212° F.		Combustion per sq ft. grate lbs. per hour.		LBS. PER TON-MILE CARS. Coal.		Water.	
Column	1.	2.	3. %	4.	5. %	6.	7. %	8.	9. %	10.	11. %	12.	13. %	14.	15. %	16.	17. %
H 68 inch drivers	145	5.76	100.0	32.9	102.0	4.63	100.0	26.5	102.3	6.93	100.0	89.9	100.0	.178	100.0	1.02	100.0
M 69 " "	617	5.89	102.0	22.2	100.0	4.76	102.8	25.9	100.0	6.59	95.0	103.9	116.0	.198	111.0	1.07	105 0
H 62 " "	150	6.50	113 0	35.15	109.0	5.31	114.6	28.9	111.6	6.66	96.0	106.0	118.0	.194	109.0	1.06	104.0
Comp. H 62 inch drivers	324	7.67	133.0	42.8	133.0	6.10	131.8	34.0	131.2	6.85	99.0	105 5	117.0	.211	118.0	1.17	115.0
Baldwin comp. 72 inch drivers	82	7.94	138.0	39.2	122.0	6.33	136.7	31.2	120.4	6.23	90.0	121.9	136.0	.223	125.0	1.10	108.0

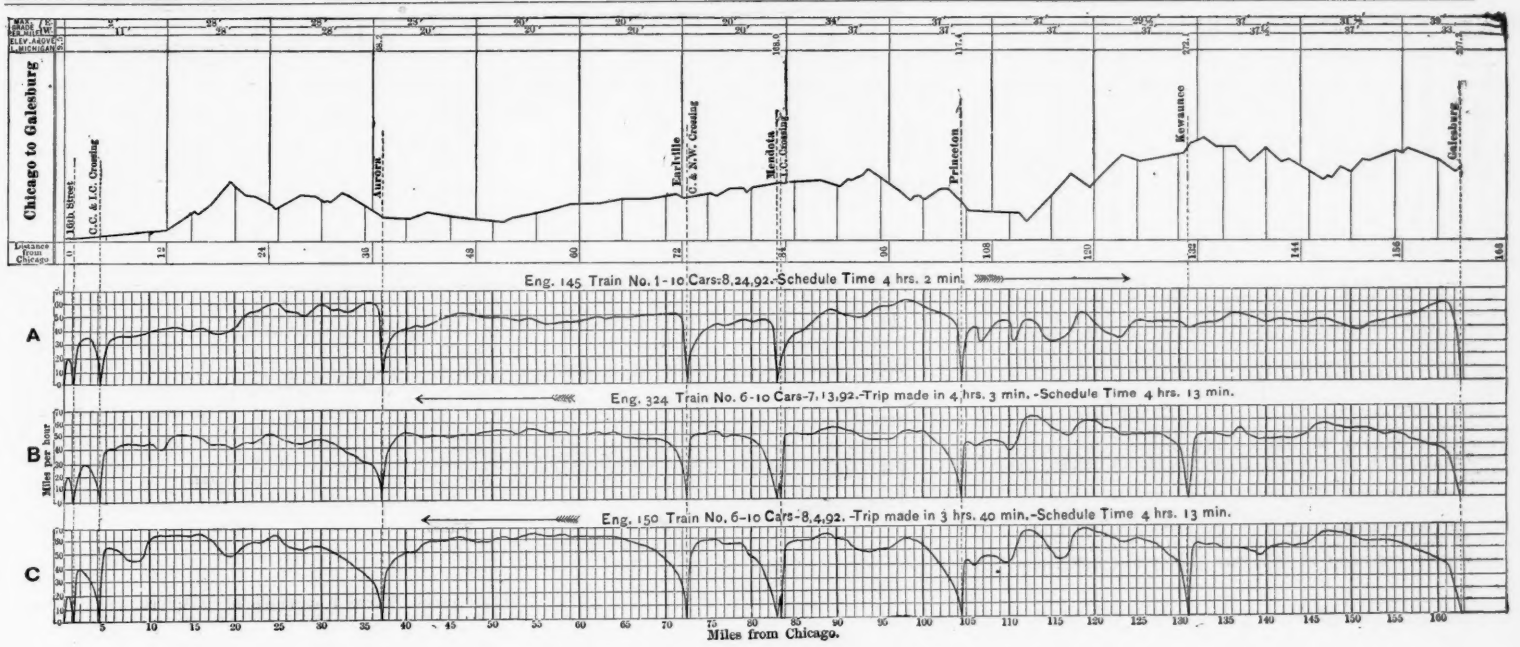


Fig. 5—Profile of Road and Fluctuations of Speed.

Tests of Locomotives in Heavy Express Service.

DIMENSIONS OF LOCOMOTIVES.

	Fig. 1.	Fig 2.	Fig. 3.	Fig. 4.
Type	American.	Mogul.	American.	Ten-wheel.
Class	C., B. & Q. "A."	C., B. & Q. "H."	C., B. & Q. "M."	Baldwin compound.
Centres of cylinders	Ft. In. 6 1	Ft. In. 7 1	Ft. In. 6 4	Ft. In. 7 2½
" valve stems	6 0	6 4¾	5 11	4 3½
Between frames	3 8	3 5	3 5	3 7
Length bumper beams F.	8 0	9 0	8 8	9 4
" " " T.	8 6	9 2	9 2	8 6
Width cab	7 7½	9 2	8 6	9 4
" tank	7 6	8 6	8 6	8 10
Firebox inside height	5 9¼	4 ft. 3½ in. and 4 ft. 5½ in.	4 ft. 2¾ in. and 5 ft. 0 in.	4 ft, 8½ in. and 6 ft. 1½ in.
" " width	2 11¾	3 6	3 6	2 10
" " length	6 0	9 0	7 0	10 0¼
	Sq. ft.	Sq. ft.	Sq. ft.	Sq. ft.
Heating surface tubes outside	1,078	1,380	1,301	1,965
" " firebox	112	126	111	170
Heating surface, total	1,190	1,506	1,412	2,135
Grate area	17.6	27.1	24.5	28.3
Tank capacity	2,750 galls.	3,480 galls.	3,480 galls.	3,600 galls.
Coal	14,550 lbs.	8 tons.	8 tons.	6 tons.
	Lbs.	Lbs.	Lbs.	Lbs.
Weight coal and water	37,450	45,000	45 000	.....
" tender empty	24,200	29,000	29,000	.....
" " loaded	61,650	74,000	74,000	82,000
Engine working, order:				
Front drivers	.....	29,500	.....	32,000
Main "	27,500	33,500	33,000	34,500
Back "	27,000	31,500	33,000	32,500
Total on Drivers	54,500	94,500	66,000	99,000
" truck	28,300	18,500	34,000	34,500
" engine	82,800	113,000	100,000	133,500
" E. and T.	144,450	187,000	174,000	215,500

The C., B. & Q. Compound was built for fast freight service, has 62-in. driving wheels and has never showed an improved economy over simple engines of the same class when used in passenger service. The high speeds at which the trains were run compelled a shorter average cut-off (⅙ stroke) than is economical for compound locomotives. A considerable loss of steam was caused by a leaky safety valve, and a leak from the high-pressure cylinder to the low-pressure cylinder through a cracked port plate. With these disadvantages the figures cannot be used for comparisons.

The Baldwin Compound would not steam freely when it first arrived on the road, and the grates and draft appliances were changed to suit Streator coal, but the pressure was not regular, and the performance suffered.

The following table gives the blow-off point and the average boiler pressures during the runs and the difference between them:

TABLE NO. 2.

Engine.	Blow-off point.	Average pressure.	Below maximum.	Average speed excluding stops, miles per hour.
No. 82	190 lbs.	176.8 lbs.	13.2 lbs.	42.3
No. 324	180 lbs.	171.1 lbs.	8.9 lbs.	42.6
No. 150	170 lbs.	157.3 lbs.	12.7 lbs.	43.1
No. 145	170 lbs.	159.9 lbs.	10.1 lbs.	42.6
No. 617	170 lbs.	161.0 lbs.	9.0 lbs.	43.2

The boiler pressure was taken every five minutes while the engines were in motion.

All tests were made on train No. 1 west, and train No. 6 east, on account of the daylight runs and the high speeds made by these trains. Train No. 1 leaves Chicago at 1 p. m., arrives at Galesburg, 162¼ miles west, at 5:02 p. m., making six intermediate stops; No. 6 leaves Galesburg at 10:02 a. m., arrives at Chicago at 2.15 p. m., making eight intermediate stops.

SPEED.

Fig. 5 shows a profile of the road and the fluctuations in speed.

Speed diagram "A" shows the train No. 1 running on regular schedule time, Chicago to Galesburg; diagram "B," train No. 6, on regular schedule time, Galesburg to Chicago, with the compound "H" engine No. 324; diagram "C" shows a fast run made by No. 150 on Train 6 with 10 cars, weight 337 tons, on which the trip was made in 3 hours and 40 minutes, at an average speed, excluding stops, of 47 miles per hour.

As illustrating the power of the different engines in accelerating the train from a state of rest to 40 miles an hour, speed-cards taken from the dynamometer record are given in fig. 6 for the start from Aurora east. The grade here is up 28 ft. per mile for about 1¾ miles, and is up 12⅛ ft. per mile the remaining distance shown on the diagram. Class "H" engines Nos. 145 and 150 reached a speed of 40 miles per hour in a little over 350 seconds; the engine No. 150 in a distance of 14,520 ft.; engine No. 145 in 15,730 ft. The Baldwin compound required more than 425 seconds to reach a speed of 40 miles an hour, and ran a distance of 17,600 ft. The difference here is slightly in favor of the class "H" engines.

Fig. 7 shows the time required to attain a speed of 45 miles per hour running west from the C. & N. W. crossing, where the up-grade is only 4.24 ft. per mile. The Baldwin compound, with 11 cars, attained a speed of 45 miles per hour in 275 seconds, and in 11,605 ft.; the class "H" engines requiring 325 and 350 seconds, running 14,410 ft. for the No. 150 and 16,170 ft. for the No. 145. The C., B. & Q. compound required 290 seconds and 12,430 ft. The curves indicate that the Baldwin engine, with its train of 12 cars, did not accelerate its train to running speed quite as rapidly as the Class "H" engines. With 11 cars it could attain running speed in nearly one minute less time and in 3,500 less feet than the "H" engines.

With a train of 10 cars somewhat faster time could be made with the Baldwin engine, but with a train proportioned to its weight it cannot reduce schedule time.

COAL.

Streator coal, giving the following analysis, was used throughout the test:

Volatile combustible	35.58
Moisture	7.20
Fixed carbon	45.30
Ash	8.60
Sulphur	3.30
	99.98
Coke	53.87

The coal was carefully weighed on the tender, and in addition, 25 sacks each containing 100 lbs. of coal, were placed around the top of the tank water leg. About 250 lbs. of extra coal was placed in front of the coal board, and used in getting the engine from the roundhouse to the station. The coal was carefully weighed off at the terminal. The amounts of coal in fire-box at the beginning and end of the trip were made as nearly uniform as possible.

The ash-pans and smoke-boxes were not cleaned during the trips, and for a time the ashes and sparks were weighed. The Baldwin engine threw more sparks and wasted more coal through the stack than either the simple or Compound H engines. The amount of ashes in pan amounted to 7 per cent. of the coal used. The cinders in smoke-box of Baldwin Compound at end of trips weighed 700 to 900 lbs., or an average of 5.7 per cent. of the coal used. With the C., B. & Q. compound, only 200 to 300 lbs. cinders were found in the smoke-box at the end of the trip, or 2.2 per cent. of the coal used. The effect of the exhaust on the fire is much more favorable in a two-cylinder compound than in a four-cylinder compound. The ratio of evaporation in the C., B. & Q. compound was 10 per cent. better than the Baldwin.

WATER MEASUREMENTS.

Water was measured by 2-inch water meters, one on each side, placed in the feed pipe, just beyond the tank hose. The meters were calibrated, and found accurate within ¼ of 1 per cent. Five minutes before the train left the starting station, the height of water in the boiler was marked on the gauge glass, and the reading of the water taken. Before arrival at the terminal station the water was allowed to get below the point marked at starting, and immediately after arrival, while the engine was standing still, the boiler was carefully filled up to the starting point by injectors, and the meters again read. The difference in the readings represents the water used on the trip. Proper corrections were made for water wasted at injector overflow and at the safety valve.

INDICATOR WORK.

New Crosby indicators were used in testing the C., B. & Q. engines and Tabor indicators on the Baldwin Compound. Representative cards, at speeds near 20, 40 and 55 miles per hour, are shown for the different engines in figs. 8, 9, 10 and 11. Figs. 12 and 13 show combined cards from the C., B. & Q. Compound No. 324 at speed of 35 and 50 miles an hour, and figs. 14 and 15, show combined cards from the Baldwin Compound No. 82.

The following tables, 4, 5, 6, 7 and 8 give the detailed results obtained for engine and boiler performance, trips being selected in which the conditions for the different engines were nearly uniform. Table 9 gives the *general results*, showing the engine and boiler performance. Where "H. P." is used it refers to dynamometer measurement of the train resistance. Columns 3 and 5 show the relative standing of the engines, expressed in percentages, the best record being taken as 100.

The great difficulty in comparing the efficiency of different locomotives is to obtain an actual measurement of the total resistance overcome. If it were possible to take a continuous indicator card, the total power consumed by the engine and train on a given run could then be determined, but cards taken at long intervals cannot be used as representing the average work done. The re-

sistance measured by the dynamometer is that of the train only, but for this we have a continuous record of the whole trip, and it is believed to be an accurate measurement of the work done by the engine in hauling the train. In tables 4 to 8 this is expressed in dynamometer work "H. P." hours as a more convenient and less cumbersome figure than the usual expression of foot pounds. The total amount of coal used divided by the "H. P." hours, gives us directly the pounds coal per "H. P." per hour as a measure of the efficiency of the engine and boiler, while the total amount of water divided by the "H. P." hours gives us pounds of water per "H. P." per hour as a measure of the engine's efficiency. The figures showing the evaporation from and at 212° F. give us the boiler efficiency. As a basis of comparison the engine resistance may be omitted and the useful load of cars hauled alone considered. Table No. 9, based on dynamometer measurements of train resistance, shows that the C., B. & Q. engine No. 145, Class "H," 68-in. drivers, was the most economical, while engine No. 617, Class "M," 69 in. drivers, was practically the same for light trains. Engine No. 150, Class "H," 62-in. drivers, burned 13 per cent. more coal per horse power hour than No. 145. Four per cent. of the greater economy of No. 145 is shown by columns 10 and 11 to be due to the better evaporation. Columns 4 and 5 show that No. 145 used steam seven per cent. more economically than No. 150, owing to the larger drivers. The Class "H" engine, with 68-in. drivers, is more economical than with 62-in. drivers, for such trains of 10 cars or under; but with more than 10 cars an engine with 62-in. drivers is the more economical. Engine No. 145, with 12 cars, used 34.3 lbs. water and 6.7 lbs. of coal per horse power per hour, while engine No. 150, with 12 cars, showed 31.9 lbs. water and 6.26 lbs. coal per horse power hour. Table No. 9 shows that Class "M" engine No. 617 burned two per cent. more coal than No. 145, having the same sized drivers and used steam two per cent. more economically than No. 145. A comparison of the trips of Class "H" engine No. 145, with the Baldwin Compound No. 82, columns 3 and 5, show that the latter burned 38 per cent. more coal and used 20 per cent. more water per horse power per hour. Engine No. 82 used 18 5 per cent. more coal and 14 per cent. more water than No. 145 in hauling 12 cars.

At a closer approach to the total work done, the engine resistance has been taken as the same per ton as car resistance and added to the car resistance. Columns 6 to 9. Table 9, are based on the H. P. of engine and train resistance obtained in this way. They show 36.7 per cent. more coal and 20.4 per cent. more water per H. P. per hour used by the Baldwin engine No. 82 than by "H" engine No. 145.

Table No. 9½ shows from indicator cards the efficiency of the engines, based on the foot pounds of cylinder work per heat unit at boiler pressure of steam used. The figures are averages of two trips.

At 30 m. p. h. the compound engines are more economical than the simple, but at 45 m. p. h. (average speed when train was under way), the simple engines are more economical, because at this speed and cut-off the simple engines worked steam with more expansions than the compounds, and the back pressure and loss in the steam passages of the latter were more than for the simple. Comparing engines No. 145 and No. 82 at 45 m. p. h., engine No. 145 developed 15.7 per cent. more foot-pounds of work from a heat unit than engine No. 82, and engine No. 617, 4 per cent. more than No. 145.

The coal required to make a round trip from Chicago to Galesburg and return, with 12 cars on schedule time, was as follows:

Baldwin Compound	27,522 lbs.
Class H., No. 150	23,672 lbs.
Difference	3,850 lbs.

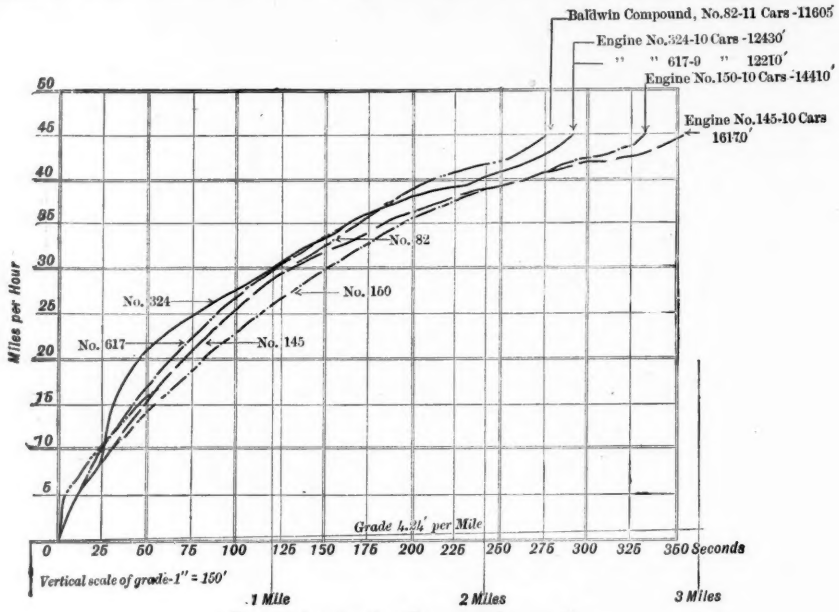
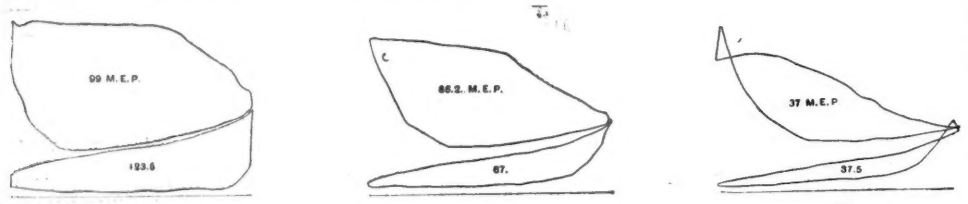
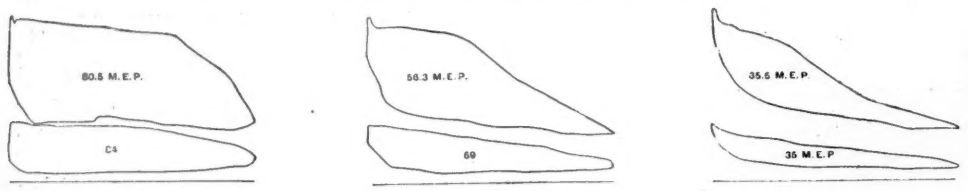


Fig. 7—Accelerating Power of Locomotives.



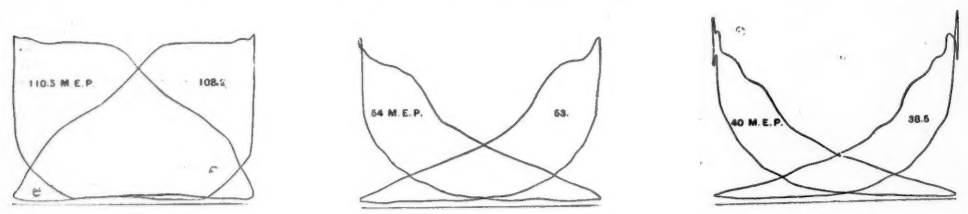
Speed miles per hour	20	40	55
Tractive force	14,389	8,665	4,831

Fig. 8—Indicator Cards, June 6, 1892, Baldwin Compound No. 82.



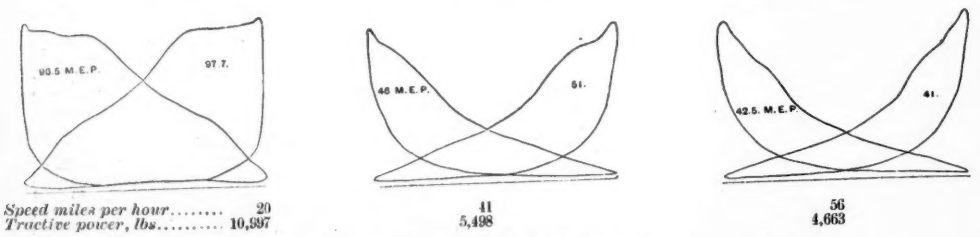
Speed miles per hour	22	35	48
Tractive force	12,800	8,888	5,486

Fig. 9—Indicator Cards, July 15, 1892, C., B. & Q. Compound No. 324.



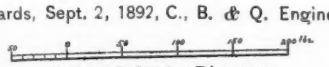
Speed miles per hour	18	40	55
Tractive force	13,913	6,727	4,994

Fig. 10—Indicator Cards, Aug. 18 and 19, 1892, C., B. & Q., Class H, Mogul No. 145.



Speed miles per hour	20	41	56
Tractive power, lbs.	10,997	5,498	4,663

Fig. 11—Indicator Cards, Sept. 2, 1892, C., B. & Q. Engine, Class M, No. 617.



Scale of Indicator Diagrams.

Or 16 per cent. in favor of the simple engine. The Baldwin compound had:

17 lbs., or 11 per cent., higher boiler pressure;
41 per cent. more heating surface;
20 per cent. greater weight of engine and tender;
6 in. greater diameter of boiler.
4 in. larger drivers.
8½ lbs. less average steam pressure at cut-off.

The measured weight of coal and water shows that the Baldwin Compound used 25 per cent. to 38 per cent. more coal, and 13 per cent. to 22 per cent. more water per dynamometer horse-power, than any of the simple engines tested, and we must conclude that this is largely due to the uneconomical use of steam in the Baldwin Compound cylinders. We account for it in part by the fact that the average cut-off was 15 in. or ⅝ stroke in the high pressure cylinder. The cards show that at speeds as high as 59 miles an hour this long cut-off was maintained, and as a consequence steam had to be throttled from 177 lbs. down to from 120 lbs. to 145 lbs. to prevent undu compression. The average steam line of 12 cards taken at speeds of 45 to 50 miles an hour was 129 lbs.—a drop of 48 lbs. below the 177 lbs. available in the boiler—a loss of 27 per cent. in pressure to cylinder. The average steam line of 8 cards from Class "H" engine No. 145, at the same speed, shows a pressure of 137½ lbs., or a drop of 22½ lbs. from the average boiler pressure of 160 lbs., or 14 per cent.; about one-half that of the Baldwin. The average steam pressure up to cut-off was 8½ lbs. greater in the simple engine.

TABLE NO. 9½.

Engine.	Speed.	Ft. lbs. per heat unit.	Efficiency 772 ft.-lbs per heat unit. Per cent.
145	31.5	75.9	9.8
617	31	77.2	10.1
324	31	83.1	10.7
82	30	87.1	11.2
145	45	84.1	10.9
617	45	87.5	11.3
324	45	72.2	9.3
82	45	72.7	9.4

With an average cut-off of ⅝ stroke, and ratio of cylinders 1:3, the Baldwin Compound did most of its work with 4.8 expansions. The simple engines when running at speeds cut off at 4 in. and 5 in., and the steam had five to six expansions. The simple engines, therefore, had the advantage of higher pressure up to point of cut-off, and a higher rate of expansion, the two most important qualities which a compound engine must possess in order to produce a superior economy.

Referring to cards Nos. 35 (fig. 14A) and 31 (fig. 14) from the Baldwin Compound, the weight of steam in the high pressure cylinder, at 15 in. cut-off, was .4233 lb., and in the low pressure cylinder at 18 in. cut-off, just after valve closure, it was .4751 lb., a difference of 12.2 per cent.

The card on which expansion line is drawn shows some leakage through the valve to the high pressure piston, and a considerable admission of live steam to the low pressure cylinder, through the starting valve while running at 45 miles per hour. On card No. 31 (fig. 14) this extra admission is found to be 15 per cent. of that admitted to the high pressure cylinder at the point of cut-off.

GENERAL CONCLUSIONS.

1. The coal measurements show 22 per cent. more tons of cars hauled per pound of coal by the simple Class H. engines than by the Baldwin Compound.

2. The average rate of evaporation was 5 per cent. more with the simple Class H. engines than with the Baldwin Compound.

3. The cylinder performance measured by the indicator cards, taken at average running speed, 45 miles per hour, shows 18 per cent. more foot-pounds of work done per heat unit in the steam used by the simple engines than by the Baldwin Compound.

4. At 30 miles per hour the cards show the Baldwin engine to have the best economy, developing 14 per cent. more work per heat unit than the Class H simple engines.

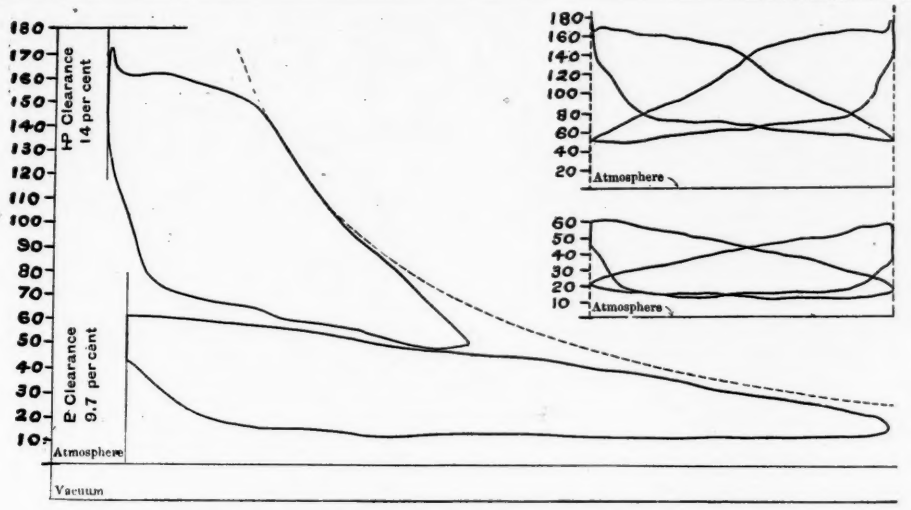
5. The poor showing made by the Baldwin Compound was largely due to the heavy train and high speed. With a lighter train, or the same train on a slower schedule, it would have shown a much better economy. The cards taken at 30 miles per hour show this.

6. The Baldwin Compound Engine, as operated on the C., B. & Q. R. R. on trains 1 and 6, weighing 350 to 400 tons, was not as economical in the use of coal as the C., B. & Q. simple class H engines, by about 25 per cent.

7. When worked in heavy express service the Baldwin Compound 82 lost the principal advantages of compounding, namely:

A. High initial pressure in the cylinders.
B. Increased number of expansions.
C. Softer blast on fire. As a result its boiler performance and cylinder performance were not as good as simple engines of proper capacity.

The above shows that the smaller the amount of coal burned per square foot of grate per hour, the greater the evaporation, and at slower speeds the evaporation should increase. The average evaporation in the above table, 6.5, is the same as that obtained from the same coal burned in a cylindric, tubular stationary boiler, at a rate of 25 lbs. per square foot of grate per hour. This shows that the locomotive boiler with properly proportioned grate and good draft appliances will burn five times as much coal per square foot of grate per hour with as good economy as the average stationary boiler.



INDICATOR CARD NO. 15, JULY 15, 1892, C., B. & Q. COMPOUND, CLASS H, MOGUL.

Speed 35 miles per hour, 193 revolutions; diameter drivers 62 in.

Fig. 12.

TABLE NO. 10.—SHOWING RATE OF EVAPORATION AS AFFECTED BY RATE OF COMBUSTION.

Engine.	Combustion lbs. coal burned per sq. ft. grate per hour.	Evaporation lbs. water per lb. coal from and at 212° F.	Order.
145	89.9	6.93	1
324	105.3	6.85	2
150	106.0	6.66	3
617	103.9	6.59	4
150	109.2	6.25	5
82	121.9	6.23	6
150	125.5	6 02	7
	Average, - - -	6.50	

TRAIN RESISTANCE.

The dynamometer records show the amount and variation of passenger car resistance for the whole of all trips. The paper traveled one foot per mile. On these diagrams points have been selected where the track was comparatively level, and the speed uniform, and the train resistance per ton and pull on tender drawbar obtained at such points are given in table No. 12. The average resistance per ton of cars at speeds 30 to 46 m. p. h. is 13.5 lbs., and the pull at tender drawbar 4,719 lbs. At speeds 48 to 52 m. p. h. the resistance shows 9.77 lbs. per ton, and pull 3,560 lbs. The reason for this being less is doubtless because at the lower speeds, although the speed was apparently uniform, yet the train was being accelerated to higher speed. At 48 to 52 m. p. h. the train had attained a velocity where it almost drifted along, and the demand on the engine was very light. This illustrates the difficulty in getting exact figures for train resistance where there is such constant fluctuation in speed and pull. At average speed of 54.6 m. p. h. the resistance is 12.3 lbs. and pull 4,143 lbs.; at 59 m. p. h. it is 12.2, and 4,100 lbs. pull; and at 61 m. p. h. the record shows 10.8 lbs. and 3,600 lbs. pull, with 10 to 12 cars.

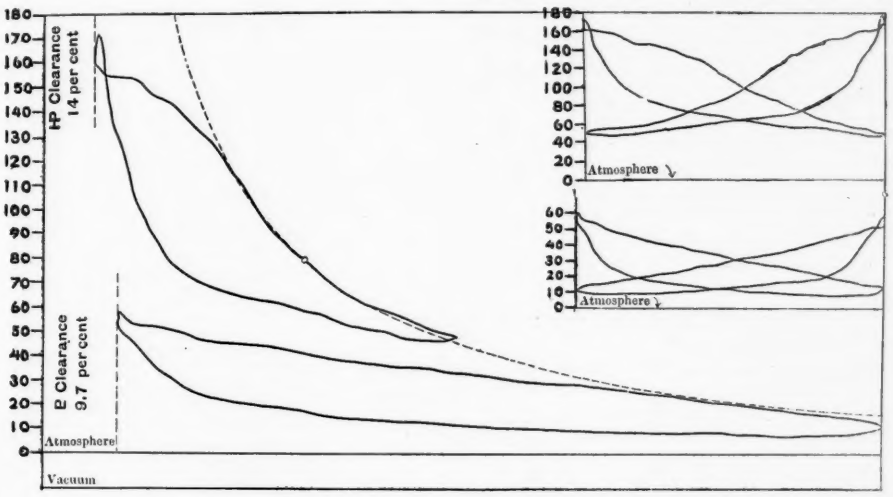
Table No. 12, giving the average of from five to ten trials at each set of speeds, indicates that passenger train car resistance is almost constant at 40 to 60 m. p. h., and about 12 lbs. per ton on level at uniform speeds in summer when winds are light.

In these tests the car resistance at running speeds 40 to 60 m. p. h. is about 60% to 70% of total indicated tractive power of the engine.

TABLE NO. 12.—AVERAGE PASSENGER CAR RESISTANCE, TAKEN ON LEVEL AT VARIOUS UNIFORM SPEEDS.

Speed, miles per hour.	Resistance, lbs. per ton of cars.	Length of record taken.		Tons of cars.	Resistance at tender draw-bar.
		Time, seconds.	Distance, miles.		
42.25	13.5	83.6	7.96	351.46	4,719
49.9	9.7	165.3	2.3	366.4	3,560
54.6	12.3	113	1.7	336.4	4,143
55.8	11.56	112	1.8	341.96	3,730

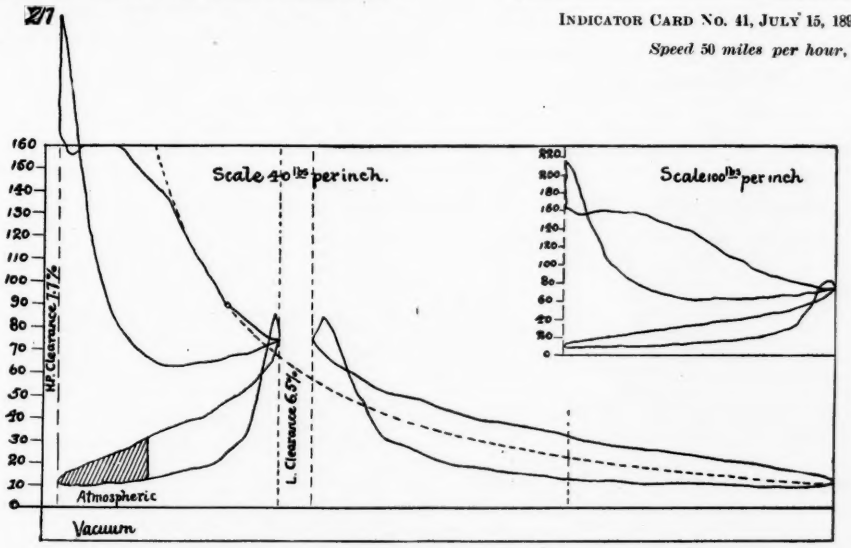
Figs. 15 and 16 show a distribution of the total indicated H. P. into 1st, car resistance; 2d, the pull required by the engine (treating it as a heavy car, and including wheel, rail and journal resistances only at the same rate per ton as found for cars), leaving the balance to represent head air and wind resistance, as well as all internal friction of machinery.



INDICATOR CARD NO. 41, JULY 15, 1892, C., B. & Q. COMPOUND, CLASS H. MOGUL, NO. 324.

Speed 50 miles per hour, 271 revolutions; diameter drivers 62 in.

Fig. 13.



INDICATOR CARD NO. 31, JUNE 2, 1892, BALDWIN COMPOUND NO. 82.

Speed 58 miles per hour, 270 revolutions; diameter drivers 72 in.

Fig. 14.

In fig. 15, *a* is the zero point, line *ab* represents pounds pull, and *ac* speed in miles per hour. The line *bd* represents the indicated tractive power of engine in pounds at various speeds, 58 indicator cards having been used in constructing the curve. The horizontal distance from any point in line *bd* to *ac* shows the tractive power corresponding to speed at that point; line *gi*, fig. 15, shows total tractive force of engine at 35 miles per hour to be 10,000 lbs. The line *ef* represents the car resistance in pounds pull on tender drawbar measured horizontally from line *bd*, and line *gh* shows pull of 8,000 lbs. at 25 miles per hour, and *hi* 2,000 lbs., the remaining tractive power, which must include all engine and head resistance. The between lines *ef* and *ac* is still further divided by line *kl*, which represents the engine resistance considered as a car, and the remaining space between *kl* and *ac* must account for all head wind and internal resistance of machinery.

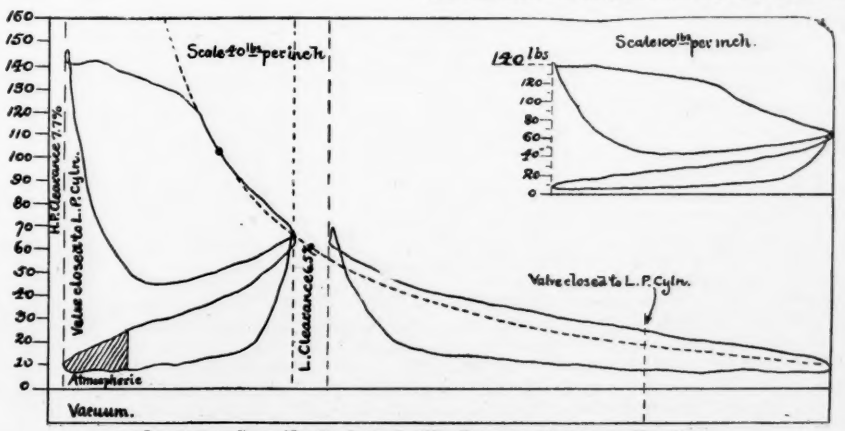
The magnitude of these three resistances can be taken as proportional to the pull in pounds, and in fig. 15 the curve shows that at 60 miles per hour total resistance is 4,750 lbs., made up of

	Lbs.	
Car resistance	3,500 = 73.6	per cent.
Engine and tender, rolling and journal friction	750 = 15.8	"
Head wind and internal engine friction	500 = 10.6	"
	4,750 = 100	"

(Further tables and diagrams will be found on the next page.)

TABLE NO 11.—TRACTIVE POWER AT VARIOUS SPEEDS, OBTAINED FROM INDICATOR CARDS, FIGS. 7 TO 10.

	Speed M. P. H.	Rev.	Tractive power.
Baldwin engine, No. 82	20	93.	14,389
H, C., B. & Q. compound, No. 324	22	122.	12,800
H, C., B. & Q. simple, No. 145	18	89.	13,913
M, C., B. & Q. simple, No. 617	20	97.6	11,000
No. 82	40	185.7	8,665
No. 324	35	122.	8,888
No. 145	40	197.7	8,727
No. 617	41	200.	5,496
No. 82	55	256.8	4,834
No 324	48	265.	5,486
No. 145	55	266.9	4,994
No. 617	56	273.3	4,663



INDICATOR CARD NO. 35, JUNE 6, 1892, BALDWIN COMPOUND NO. 82.

Speed 45 miles per hour, 210 revolutions; diameter of drivers 72 in.

Fig. 14A.

TABLES 4, 5, 6, 7 AND 8.

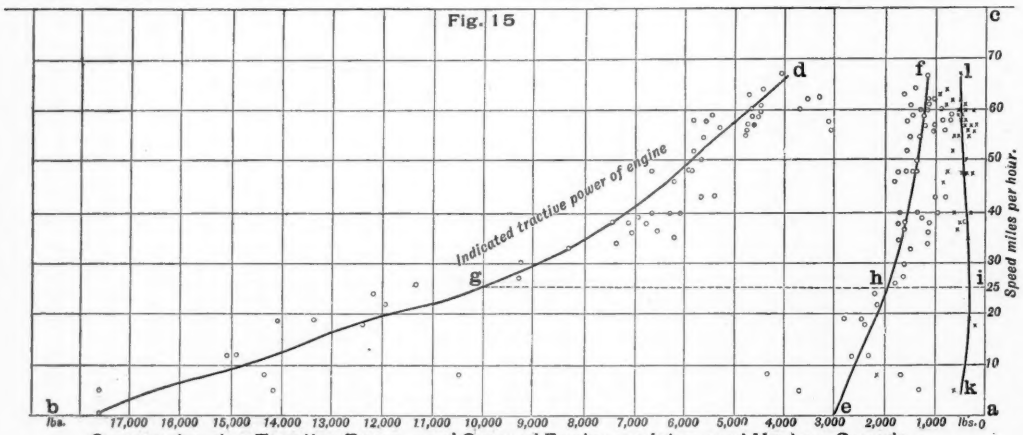
Average Results of Tests between Chicago and Galesburg. Trains 1 and 6.

No. table	IV.	V.	VI.			VII.		VIII.		
Locomotive class	Baldwin 10-wheel compound.	C., B & Q. Mogul compound.	C., B. & Q. H. Mogul.			C., B. & Q. H. Mogul.		C., B. & Q. M. American.		
Drivers, dia	72 in.	62 in.	62 in.			68 in.		69 in.		
No. of Locomotive	82	324	150			145		617		
Mean running weight, E. & T., lbs.	197,100	172,900	164,500			164,500		151,500		
Number of cars	12	10	10	10	12	10	12	9	10	11
Weight, cars, lbs	775,700	672,700	733,790	671,035	793,600	679,292	772,210	635,067	697,700	671,300
Dyna. work, H. P. hours	1772.8	1499.	1775.3	1752.4	1895.4	1709	1771	1731	1629	1905
Coal used, lbs	14,076	11,496	11,545	12,616	11,836	9,829	11,793	10,214	10,262	10,912
Tons cars one mile per lb. coal	4.47	4.77	5.17	4.32	5.44	5.63	5.32	5 05	5.52	5.00
Lbs. coal per H. P. per hour	**7.94**	**7.67**	**6.50**	**7.08**	**6.25**	**5.76**	**6.70**	**5.89**	**6.30**	**5.73**
Water evaporated, lbs	71,232	65,709	64,296	63,493	61,879	56,849	61,586	56,117	51,832	60,859
Water used, lbs. (corrected)	69,424	64,087	62,936	61,099	60,399	56,205	60,761	55,426	51,019	60,287
Lb. water per H. P. per hour	**39.2**	**42.8**	**35.15**	**34.85**	**32.0**	**32.9**	**34.3**	**32.2**	**31.3**	**31.6**
Lbs. water evaporated per lb. coal	5.13	5.71	5.57	5.04	5.24	5.79	5.22	5.49	5.02	5.58
Evaporation from and at 212 deg.	6.23	6.85	6.66	6.02	6.26	6.93	6.22	6.59	6.01	6.68
Average steam pressure	176.8	171.1	157.3	161.7	161.2	159 9	158.2	161.0	160.0	161.4
Average speed, excluding stops	42.3	42.6	43.1	47.35	43.5	42 6	45.9	43.2	41.7	43.3
Working steam, minutes	204	208	198	179.5	198.5	205.6	196	205	198	197
Average temperature air	75°	86°	83°	96°	89°	84°	102°	82°	71°	82°
Av. temp. feed water in tank	60°	70°	71°	74°	74°	71°	76°	67°	64°	69°
Lbs. coal per hour per sq. ft. grate	121.9	105.3	106	125.5	109.2	89.9	108.3	103.9	103.7	110.8

Curves showing Tractive Power, and Car and Engine resistance at Various Speeds.

Weight of Engine and Tender, 151,500 lbs. M. Engine 617. Weight of Cars, 697,700 lbs.

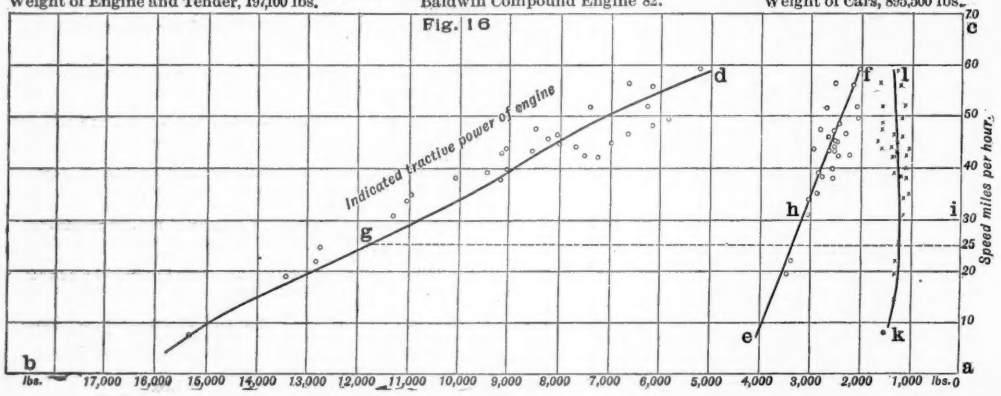
Fig. 15



Curves showing Tractive Power, and Car and Engine resistance at Various Speeds.

Weight of Engine and Tender, 197,100 lbs. Baldwin Compound Engine 82. Weight of Cars, 895,500 lbs.

Fig. 16



Caisson Foundations in Building.

Although caissons sunk by the pneumatic process are in common use as foundations for large bridge piers and abutments, yet, so far as known, the new Manhattan Life Insurance Building, at 64 Broadway, New York City, is to be the first fireproof building in the world to be carried to solid rock by means of such foundations.

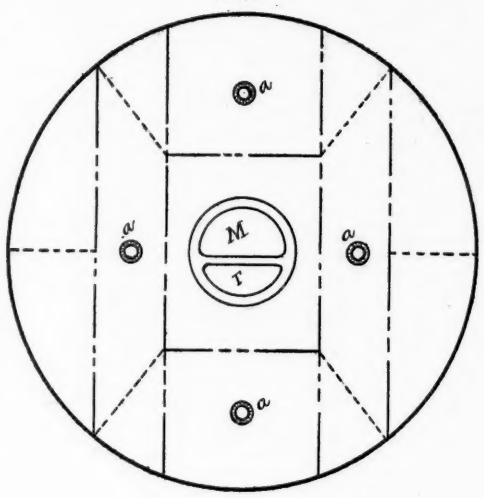
The ground area to be covered by this building is approximately 122 ft. by 67 ft., in which space will be sunk 15 caissons, 11 rectangular and four circular. Of the circular caissons the largest is 15 ft. in diameter, the smallest 10 ft. The rectangular caissons vary in size from 25½ ft. long by 21½ ft. wide to 13 ft. square, according to the requirements of the building. The principle of their construction is the same for any shape. They are made of steel plates, angles and beams, riveted, and are eight to ten feet deep. The sides and top covering are made of rolled steel plates, the framework is made of angles. To distribute the loading properly, steel I-beams (shown in the sketch plan by broken lines) are placed on top, and brackets (shown in both sketches by dotted lines) are built inside the caisson at regular intervals to carry the weight from the beams more directly to the cutting edges of the caissons. All rivets and bolts through the side of the caisson are counter-sunk on the outside and care is taken to eliminate friction on the sides as much as possible. The total weight of these 15 caissons is about 400 tons.

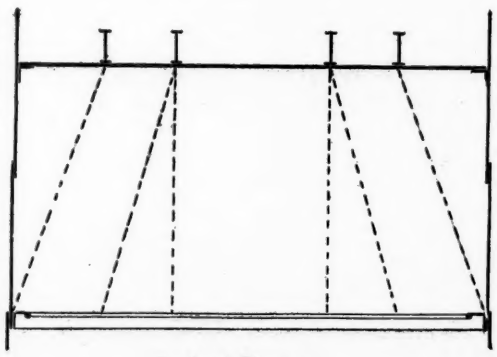
Workmen are admitted through the manhole *M*, which also serves for the passage of tools and the dredging buckets for coarse stones and material that cannot be blown through the 4-in. openings shown at *a*. The opening *T* will be used for filling the chamber with concrete when the caisson has reached bottom. Of course all of the openings are carried up through the masonry as the work progresses and are provided with the same valves as in ordinary submarine work. Through the 4-in. openings the material is to be blown out, as is usual in this sort of work. Four-inch rubber hose, served with wire to prevent collapse, and terminating with a nozzle drawn down to 2½ in., is attached to each of the 4-in. openings marked *a* so as to command the whole area in the caisson.

The piers will be sunk to rock 54 ft. below the curbstone at that point in Broadway. When reached the rock will be roughly dressed to an approximately level bearing, and the interstices will be filled in solidly with Portland cement concrete. Finally, the inside of the caisson itself will be filled with stone and concrete through the opening *T*, and the pier will stand completed.

Of course the theory and practice of the pneumatic caisson is thoroughly familiar to our readers, but this application of the method is highly novel. It is used in this case because the foundations will have to be carried through quicksand with much infiltrated water, and on either side are lofty and heavy buildings. The contractors for this work are Messrs. Sooysmith & Co., of New York.

Plan.



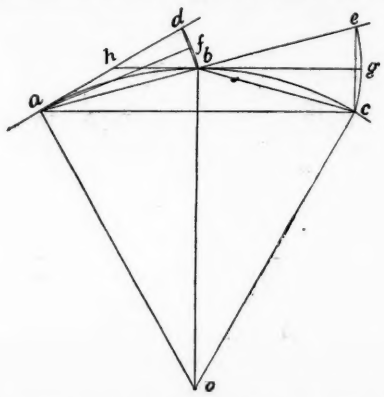


Sectional Elevation.

Deflection Angle or Tangential Angle.

In the *Railroad Gazette* of Feb. 24 there appeared a communication signed "Simplex," in which the writer says:

I solicit your aid in the direction of securing greater uniformity in the nomenclature of the angles employed in locating railroad curves. My references are to the figure inclosed. The Field Books of Henck and Searles



apply the name "deflection angle" to the angle *d a b* formed between a 100-ft. chord *a b*, and a tangent *a d* at one end of that chord, which is the constant angle, *d a b* = *b a c*, turned off (or "deflected") by the transitman from one point *a* in locating points *b*, *c*, etc., in the curve, at the ends of 100-ft. chords. But Shunk's and Trautwine's books call this the "*tangential*" angle.

"Simplex" asks for such expressions of opinion as will induce one pair of authors to accept the term used by the other pair. We give below such opinions as have been sent in. They are rather one-sided so far.

C. Frank Allen, Professor Railroad Engineering Massachusetts Institute of Technology.—I have always used the term "deflection angle" in the way that Henck and Searles use it, and my preference for this usage may be founded on acquired habit. It seems to me, however, entirely consistent and proper to apply the term "deflection angle" to the deflection or additional angle turned off *at the transit*, in order to give line for a new point 100 ft., or an even station, ahead. My own usage in instructing my classes in curve work is to call the angle turned off at the transit a deflection of some sort. For a sub-chord, the term "sub-deflection" is proper, and in no way confusing. As almost every curve begins with a sub-chord, this, if anything, is the real "tangential angle." The constant increment is the "deflection angle,"

and the angles really laid off on the transit are the "total deflections" (so called by me) from the tangent. Where the curve begins with a sub-chord, or almost always, the "tangential angle," so called, is the only angle used in laying out the curve, which has nothing whatever to do with the tangent.

The angle at the centre (which measures the change in direction of the curve up to any point) I call the "central angle." The difference in direction between the tangents, some might think, had claim to be called the deflection angle, but is commonly called the "intersection angle." It seems to me entirely clear and simple to use the terms mentioned and which I will repeat:

Intersection angles, sub-deflection, deflection angle, total deflection, central angle. It seems questionable to me whether an equally suggestive and simple series will naturally be grouped around the "tangential angle."

Ward Baldwin, Professor Civil Engineering University of Cincinnati.—I prefer the nomenclature of Henck and Searles. There seems to be no advantage in giving two names to the angle at the centre subtending a 100-ft. chord. This is conveniently designated as the "degree of the chord" by all authors, and it does not appear any more convenient to call it the "deflection angle," and then introduce a third designation, "the tangential angle," for the angle between the tangent and chord.

Channing M. Bolton, Chief Engineer Richmond & Danville Railroad.—I prefer the nomenclature of the angles as used by Henck and Searles, or, in other words, calling the angle *d a b* the deflection angle.

C. L. Crandall, Professor of Civil Engineering, Cornell University.—Starting with the assumption, which is believed to be true, that the "degree of curvature" is almost universally taken equal to the central angle subtending a chord of 100 ft., it seems unfortunate that the term "deflection angle" should be used for the angle between two adjacent 100-ft. chords, which has the same value. The term "tangential angle" is not objectionable for the angle between a tangent and a chord meeting it at the point of tangency, but there seems to be no good reason for extending it to include the angle subtended by any 100-ft. chord from a point on the circumference. The term "deflection angle" is applied to the angle which must be laid off by the instrument, or *deflected*, to reach any station on the curve from the preceding, the instrument being anywhere on the circumference. It, therefore, seems more logical than "tangential angle," and hence to be preferred unless the inquiry should show the latter to be in more extensive use and more difficult to uproot. In this college, in dealing with circular curves, a "deflection angle" has always been taken as the angle at the circumference subtending a chord of 100 ft., and the "degree of curve," as the central angle subtending the same chord, in accordance with the Henck nomenclature.

William E. Hoyt, Chief Engineer Buffalo, Rochester & Pittsburgh.—It seems to me desirable to perpetuate the old name of "deflection" angles, as used in the field books of Henck and Searles. Probably 75 per cent. of the engineers now engaged in railroad work have been brought up to employ this term for the angles designated in that way by the writers just mentioned. The number of new men who use the books of Shunk and Trautwine is probably much smaller, and it seems hardly necessary to change from what has long been considered a perfectly reasonable and convenient terminology to one which is different. For my part, I am heartily in favor of retaining the old name of "deflection" angle for the one originally designated as such by Messrs. Henck and Searles.

Walter Katté, Chief Engineer New York Central & Hudson River Railroad.—When I was a "field" practitioner some 25 or 30 years ago, the invariable practice (as far as my recollection now serves) was to call the angle *d a b* the "tangential" angle, and the angles *e b c*, *a o b*, *b o c* "deflection" angles, *never* applying the term "deflection" to the "tangential" angle *d a b*. This seems to me to be the proper, common-sense nomenclature for these angles, for the reason that "deflection" naturally suggests exactly what *it is—i. e.*, the "deflection" or "change of course" which the curve has obtained at the end of each successive chord of 100 ft. This is not the case when applied to the "tangential" angle, as that of course is always exactly one-half the deflection angle, and applies only at the beginning and the end of curve, and is simply the angle which the *first* and last chords make with the tangent.

Olin H. Landreth, Professor of Engineering Vanderbilt University.—In practice and teaching I have invariably called the angle at a transit station between the chord to any station and the preceding full station chord the "deflection angle" for that station, thus following the notation of Henck and Searles. I have sometimes regretted that the term "deflection angle" had not been reserved for another angle still, viz.: the angle between the chord from any transit point to any station and the tangent to the curve at the transit point, thus making the term "deflection angle" comply more fully with the use of that term in running angular lines with the transit.

Emile Low, Engineer Department, Norfolk & Western.—I would prefer the expression "deflection angle" as used by Henck and Searles. In this connection I would advocate a radical departure from established usage and make the degree of curvature and the deflection angle synonymous. For this reason I would change the paragraph on page 4 of Henck's Field Book for Railroad Engineers, so as to read: The *degree* of a curve is determined by *one-half* the angle subtended at its centre by a chord of 100 ft. Thus, if the angle subtended is 6 deg., the curve is a 3 deg. curve. I suppose there will be a great howl raised against this innovation and mostly for the most potent old time reason, that such action would be without *precedent*. It would certainly simplify matters to make the degree of curvature the same as the deflection angle (Henck's), and I really see no rational objection to this nomenclature.

G. B. Nicholson, Chief Engineer "Queen & Crescent" System.—I prefer Henck and Searles' term "deflection angle" for the angle formed between chord and tangent.

Joseph T. Richards, Engineer Maintenance of Way Pennsylvania Railroad.—I would prefer calling this a "deflection angle," as it is an easier word for the tongue, more readily caught by the ear in conversation, and somewhat easier to use in writing to keep notes.

Wm. H. Searles.—It seems that all authorities are agreed upon the signification of the term "degree of curve"—it applies to the angle between two consecutive chords of 100 ft., or to the angle at the centre subtended by one of them. What occasion can there be then for giving a second name to this important and characteristic angle? But when a curve is run in by transit, since the half of this angle is the amount of deflection that must be made for each successive chord of the curve, there seems to be some propriety in naming this half-angle the "deflection angle," and it is unfortunate that this term should ever have been applied to anything else. A uniformity of usage is greatly to be desired.

Geo. H. White, Professor of Civil Engineering Worcester Polytechnic Institute.—It has always been my custom to call the angle *d a b* the deflection angle. During about eight years of work on the location, construction and maintenance of railroads, I never heard any of my associates call the angle anything but the deflection angle, and am not in favor of changing the name to tangential angle.

Heat Storage in Steam Plants.*

When asked to give you a paper on some electric lighting subject, it seemed to me that I could not choose a better one than "Thermal Storage for Central Stations," which has had so much attention directed to it lately in England. It has long been evident that storage of some kind might lead to great economy in central station work. The reason of this is that the demand for light has, in most cities, a maximum for only two or three hours of the day. Not only do we require to have plant lying idle all the rest of the day, but the expense of working for those few hours is increased by its temporary character. This loss of economy has occurred both in engines and boilers. Underloaded engines are very inefficient and use up a lot of coal. The defect is, however, got over in all important central stations by having at least a few engines of small power to carry the day load. We are thus able to have engines in use always working at their most economical load; that is, near full load. The other loss in economy comes from the boilers which have to be fired up and heated only for a few hours' work and then banked or else allowed to cool down. This loss cannot be overcome by working the ordinary plant in any special manner. At the Kensington Station, in London, where the engines are always working at an economical load, 5 lbs. of coal are used per electrical horse power per hour, whereas in tests of 24 hours' duration, made on the same plant, with all the boilers doing full work, only 3½ lbs. of coal were required for the same duty. If, then, we could have storage of any kind by which power is absorbed at times of light load and given off at times of heavy load, we should save 1½ lbs. of coal per horse power per hour.

Many people have thought that storage batteries would overcome this trouble. It does so; but at an enormous capital expenditure in storage batteries, with a loss of 20 per cent. in the energy given to the batteries, and with a depreciation account which no one would put at a less figure than 12 per cent. per annum.

I have previously proposed that in a hilly country the boilers and engines should be working all the 24 hours at the rate of the average demand, and that they should be used to pump water through a pipe to a high reservoir at least 500 ft. above the pumping station. At the lower end of the pipe, turbines are placed, driving dynamos. During the daytime the reservoir is being filled, and in the evening it is being emptied. This produces a saving in boilers and the substitution of cheap turbines and a small number of efficient pumping engines for a large number of less efficient engines to drive dynamos. It also reduces the coal consumption from 5 lbs. to 3 lbs. per horse power per hour. In a paper read last year before the British Association for the Advancement of Science I showed that this plan could easily be adopted at Edinburgh, in Scotland, the saving in capital and annual expenses being both very large.

But it is not every city that has these advantages, and I wish now to introduce to your notice the excellent scheme which has been invented by Mr. Druitt Halpin, of England. He proposes to put up boilers only of the average capacity and to work them day and night. At times of light load the steam is carried through pipes into large iron reservoirs of cheap construction, and is used to heat up the water in these reservoirs to a high temperature and pressure. When the heavy demand comes on in the evening, steam is drawn from these reservoirs. The losses of heat from radiation from the reservoirs can be made very small, indeed, with proper lagging—in fact, quite imperceptible.

This is the general scheme of Mr. Halpin's plan. But it has two advantages which are not so apparent at first sight. One is the purity of water supplied to the boilers. Mr. Halpin pumps feed water into the hot reservoirs, when impurities are precipitated in a place where they can do no harm. The boilers, on the other hand, are fed from this pure water in the reservoirs. The other incidental advantage of the system is that priming in the boiler does not cause any inconvenience, as the steam is all supplied to the engines from the reservoirs. Now, it has been found from the experience with the water tube boilers, which are so much used in this country, that only 3 lbs. of coal per hour can be burned per square foot of heating surface, on account of excessive priming, instead of the 6 lbs. per sq. ft. which we can use with the Cornish or Lancashire boilers, and which might be used with water tube boilers if priming were no objection. Thus, it appears that the adoption of Mr. Halpin's system not only reduces the number of boilers that we require, but also doubles the capacity of each boiler.

Mr. Halpin has worked out the relative cost of supplying plant and power to the central stations of Berlin. . . . In this system there are four central stations, giving off about 10,000 electrical horse power. . . .

Mr. Halpin claims that he can replace 22 boilers for working in the ordinary way by five boilers and 92 of his storage cylinders, which are cheap to construct, and have, necessarily, a small depreciation. His claims, which, I must admit, seem to be quite well founded, are that, while laying out somewhat more capital on his plan, he gets a very large return from the extra capital spent. He sums up the cost of the thermal storage system as follows:

5 Babcock & Wilcox boiler	$27.050
Boiler house	9,500
Chimney	4,850
Cylinder	33,300
92 cylinders	184,000
Total.	$258,700

and he puts the cost under the existing system at $182,700.

Now, if we charge 10 per cent. to annual depreciation of boilers and only 5 per cent. on the iron cylinders, which really seems a very fair value, then the annual interest and depreciation come out almost the same for both systems, thus:

EXISTING SYSTEM.		THERMAL STORAGE.	
5% on $182,700 capital	$9,135	5% on $258,700 capital	$12.935
10% on $117,850 boilers	11,785	10% on $27,050 boilers	2,705
4% on $64,850 building	2,600	4% on $47.050 buildings	1,900
		5% on $18,400 cylinders	9,200
	$23,520		$26,740

Annual charges against thermal storage, $3,220, but the annual saving in coal is, in this special case, 7,000 tons, besides the saving in ash removals and firing. Mr. Halpin thus obtains figures giving an annual saving of $36,530 to pay interest on extra capital of $75,000, with coal about $5 per ton.

Now, the only kind of storage against which Mr. Halpin has to compete, when high land is not available for utilizing water ssorage, is the storage battery, and from his figures, which seem fair to me, the extra capital required is $732,200, and the total annual extra cost is $110,570, which shows a great advantage in faoor of thermal storage.

I consider that all these figures are very conservative and that in these days, when we are learning to realize the importance of cutting down working expenses in central stations, this system must, necessarily, occupy an important place. But it is of peculiar interest to me, owing to its applicability to a kind of work to which I have devoted a large part of my time in the last seven or eight years. I refer to the burning of the house refuse and garbage in our cities. The furnaces in which this cremation is accomplished are generally called "destructors." It has been one of the great objects before me of late years to have this title abolished, and to justify their being called "utilizers." The improvements which we have introduced in the methods of burning refuse are so great that I can now undertake to produce the following results:

Taking the ordinary house refuse, consisting of ashes, coal, wood, paper, old boots, vegetables, bones and scraps, crockery, tin cans, iron pots, bottles, and adding thereto occasionally dead cats and dogs, infected mattresses and condemned meat, I can throw the whole of these, without sorting, upon the furnaces, and without producing any offensive odors or dust I can raise the temperature of the gases where they reach the boilers to over 2,000 deg. F. From my data as to the amount collected in different houses in England per head of the population, I find that from the house refuse of any town I can supply enough steam to generate electric light at the rate of one 16-C. P. lamp per head of the population for two hours every night of the year. By doing this, I am saving the municipality from $10.000 to $20,000 per annum per 100,000 inhabitants for the cost of removal of house refuse. I am preventing these objectionable materials from being dumped in the outskirts of the city, where building operations will soon commence, or in the neighboring harbors or lakes, either of which plan is a nuisance and unhealthy. The only resulting material is a clinker, which can be broken up and which, when mixed with cement, makes admirable concrete or artificial stone for paving, while by itself it makes excellent foundations for roads.

Now these enormous advantages, of the truth of which we have ample proof, from a practice extending over nearly twenty years in England, can be worked at full economy only when the burning of refuse is quite continuous and uniform. To do this we must have storage of some kind. In hilly countries the plan I have advocated of water storage is generally available, and is very economical. In all other cases thermal storage is far and away the most economical mode of working, and, in this line alone, if in no other, I have always said, from the first moment I knew of Mr. Halpin's invention, that we have here the last item which was wanting in order to do away with the barbarous methods generally adopted for getting rid of house refuse, and, at the same time, utilizing that refuse in a manner that will confer material benefits on all the inhabitants of a great town, and pecuniary advantages on those who undertake the work.

* A paper by Mr. George Forbes read before the St. Louis Convention of the National Electric Light Association.

Elevated Railroad Matters in Chicago.

The Metropolitan West Side Elevated Railroad Company has commenced laying foundations and is pushing work on all parts of the route. The entire line has been definitely located on the west side of the river, and a part of the iron is now on the ground.

The Lake Street Elevated Railroad Co. has ordered locomotives of the Rhode Island Locomotive Works and cars of the Gilbert Car Mfg. Company, and the equipment will be almost identical with that of the Manhat-

tan Elevated of New York. The cars are to have the Hain tubular drawbar, the Gold platform gate, and the brakes are to be the Eames vacuum.

The Chicago & South Side Rapid Transit has completed its Jackson Park line up to the Illinois Central tracks. False work is now being put up for the erection of this bridge, which is to cross above the Illinois Central at an elevation of 43 ft. 11 in. above datum, and 21 ft. 6 in. above the Illinois Central tracks. The span is 230 ft. and will carry two tracks. The distance from this bridge to the terminal above the roof of the annex to the Transportation Building is about 1,700 ft.

The Chicago & Northern Elevated Railroad Company filed articles of incorporation at Springfield on March 10. The company has been organized to build an elevated road through the northwestern part of the city where transportation facilities are at present very poor. The route has not been definitely determined, but it is the intention of the incorporators to reach a central location on the south side and build in a northerly and westerly direction to the boundary of Lake County. The incorporators claim that the company has a capital of $10,000,000. The incorporators and first board of directors are W. Job, David B. Gaun, F. T. DeLong, Hollis M. Chase and Clarence N. Durand.

Locomotive for the Costa Rica Railroad.

The accompanying engraving represents one of three locomotives recently constructed by the Baldwin Locomotive Works after specifications prepared by Messrs. James Livesey & Son, London, Eng., for the Costa Rica Railway. The service for which these locomotives are intended is exceptional, being upon a road having shortest curves of 20 deg., or 288 ft. radius, while for 15 miles 70 per cent. of the line is on curve, and only 30 per cent. on tangent. Of the curves 40 per cent. are of the shortest radius, and frequently reverse without a tangent being inserted. The maximum grade is three per cent. The accompanying engraving shows the plan and profile of this part of the road. The direct distance in a bee-line between the 25th and 38th mile posts is 6.34 miles, or less than half the distance by rail.

The road on which these engines are intended to work is a branch of the existing line from Port Limon to Carillo. The length of the branch from the junction with the road at Reventazon to Cartago is 50½ miles and the difference in elevation of these points is about 4,350 ft.

The general design of the engine allows of the driving boxes and springs being placed outside and accessible, while the firebox is of ample width. The principal defects of narrow-gauge engines are thus avoided by using outside frames and overhung cranks, a method which has been much practised in Europe, but has rarely been used here, except for narrow-gauge engines, where the advantages gained more than compensate for the increased spread of cylinders and the use of overhung cranks, which are, of course, more liable to break than the ordinary crank-pin.

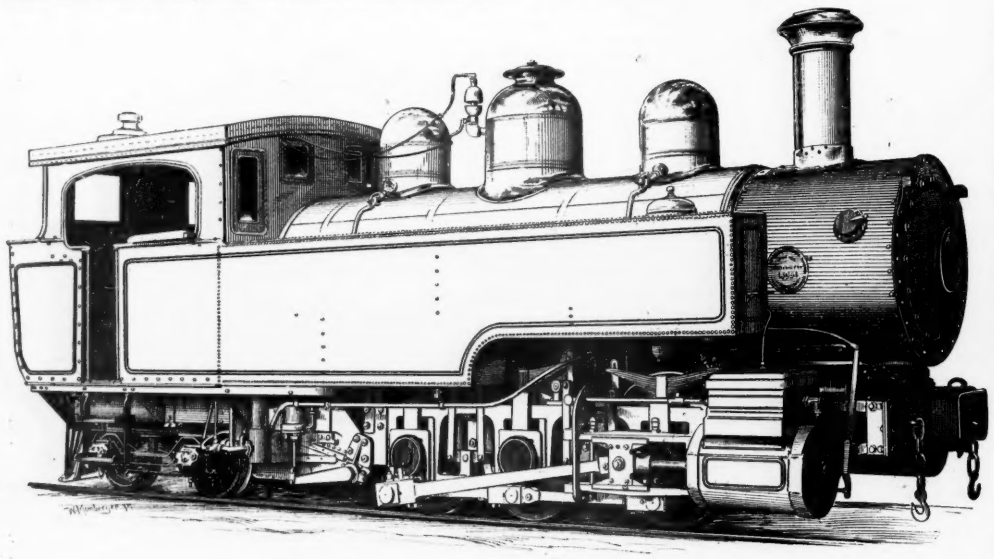
The locomotive is intended to ascend the grades with the truck ahead. The cow-catcher and headlight are, therefore, placed at what is ordinarily the rear of such a locomotive. These locomotives are guaranteed to haul 120 gross tons of cars and load at a speed of 12 miles an hour on the grades and curves shown by this profile.

These conditions may be reckoned to entail the following resistances:

	lbs.
Gravity, 3 per cent. grade	10,764
Curve resistance, ½ lb. per deg., 20 deg. curves	1,600
Axle friction train, at 6 lbs. per gross ton	720
Engine friction at 12 lbs. per gross ton	480
Total resistance	13,564
Co-efficient of adhesion, or ratio of total resistance or tractive force to weight on drivers	1-5.29
Tractive co-efficient or lbs. tractive force per lb. average pressure on pistons, lbs.	145
Mean effective pressure on pistons needed for above tractive force	93.5
Indicated horse power	434

The details of construction throughout are in accordance with American practice, as under:

Steel boiler ⅛ in. thick, designed to carry a working pressure of 140 lbs. per square inch.
Steel firebox.
Iron tubes.
Two Sellers improved self-starting injectors.
Two Crosby safety valves.
Bar frames placed outside the driving wheels.
Pennsylvania railroad type double-bar guides and crosshead.
Stephenson link valve motion.
Nathan sightfeed lubricator.
Driving boxes of wrought iron, case hardened, with phosphorus bronze bearings.
Tires of crucible steel.
Wheel centres throughout of wrought iron, made by the Vauclain process.
Steambrake on all driving wheels, operated independently by a hand screw.
Steel cab with double roof.
Two sandboxes.
Straight stack and extended smokebox.



Baldwin Locomotive for the Costa Rica Railway.

General Dimensions.

Gauge	3 ft 6 in.
Cylinders	16½ × 20 in.
Drivers, diameter	37½ in.
Total wheel base	19 ft. 4 in.
Driving wheel base	7 ft. 6 in.
Weight, total, about	90,060 lbs.
Weight on drivers, about	71,700 lbs.
Boiler, diameter	54 in.
Number of tubes	176.
Diameter of tubes	2 in.
Length of tubes	10 ft. 10¾ in.
Firebox, length	51⅛ in.
Firebox, width	52¼ in.
Heating surface, firebox	86.5 sq. ft.
" " tubes	994.2 sq. ft.
" " total	1080.7 sq. ft.
Grate area	18.7 sq. ft.
Tank capacity	1,200 gal.

The Railroads and Their Employes.

Early last week there appeared in the Chicago daily papers a communication from Mr. H. H. Porter, Chairman of the Chicago & Eastern Illinois Railroad, on the situation, particularly in Chicago, as regards the railroads and their employés. He gave tables showing the decrease in net earnings per mile of several of the more important railroads, and said that the percentage of operating expenses has very largely increased in the last five years, and that this increase must have come from increased wages. It is hardly necessary to analyze this statement, as of course the ratio of operating expenses to gross earnings depends upon several other elements than the wages account. However, there is no doubt that the time has come to stiffen up the backs of the railroad managers in their relations to their men, and the following extracts from Mr. Porter's letter show some instances of gross abuse of power on the part of the men which should be known, not only to railroad officers, but to ministers and editors all over the country:

"Within a week a passenger train going out of Chicago, filled with passengers, was delayed at a point some three miles from the centre nearly two hours, waiting for a switch to be turned that it might take its proper track. Neither the engineer, fireman, conductor nor either brakeman could turn that switch and let the train go along, because it was against the rules of each one's organization that he should do anything that did not pertain to the duties laid down for him in his particular organization. The train was only moved by some one being sent out from Chicago to change this switch. It is probable that each employé on that train would have been individually willing to turn that switch so that the train might go on and the passengers not be delayed, could he have done so without feeling the discipline of the labor organization he was a member of.

"At another time three different engines, two with trains attached, were standing in each other's way on the main track with an empty engine at the head. On this empty engine sat the engineer and fireman waiting for the switch to be turned. The superintendent of one of the railroads going by this engine asked the cause of delay, and was informed it was waiting for a switchtender to turn the switch and let them out. He said pleasantly, 'I will turn the switch,' and stepped up and did so, but this engineer refused to move because the switch had not not been turned by a regular authorized switchman, and the blockade still continued.

"Another time, pending this trouble, a switchman on on one of the switch engines stepped into the tower where a new tower man had been placed, and with the most kindly intent showed him how to do his work. Immediately the switch engine on which he was stopped its work and the corporation was notified that unless the switchman who had instructed the new man was discharged a strike would ensue, and pending this discharge this switch engine and crew remained idle.

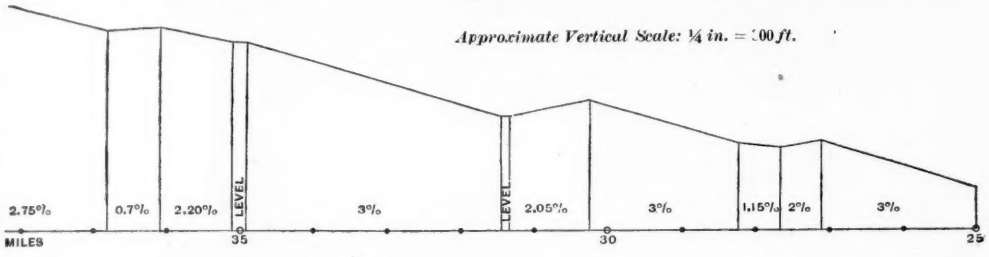
"In each of these instances mentioned every moment of time that these employés were on their trains or on their engines refusing to switch they demanded and were paid for their time, although that time was used in blocking the business of the roads they were employed by, thus demanding and receiving extra compensation for this injustice toward the railroad and the public. . . I believe to-day that the slavery of many of these men to their organizations is greater and the wrong to them and their employers much more serious than ever occurred in Russia, and is equal to the slavery in the South before the war. The men in these organizations as a rule are fairminded men. Many of them do notappreciate the hardships they demand nor the brutality used toward the employé not obeying the commands of the organization; but their leaders and walking bosses are the cause of the mischief, and often seem to vindictively in every way embarrass those who do not accede to their views."

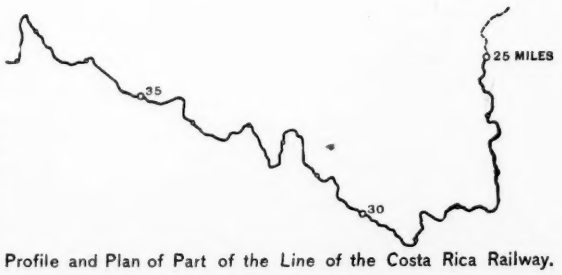
Slater & Barnes' Highway Crossing Bells.

Messrs. W. W. Slater and H. C. Barnes, of Oakland, Cal., the former Master of Signals on the Southern Pacific, have recently made certain improvements in apparatus for operating signals for warning travelers at highway crossings and have put them in use on that road. We describe the principal features of this apparatus in the accompanying drawings. As is well known, there are two principal classes of apparatus for ringing crossing bells; one in which an approaching train puts in operation a force which will ring the bell for a certain length of time (the estimated—not always the actual—length of time it will take a train to run from the ringing point to the crossing); and the other in which the train sets the bell ringing by closing an electric circuit which remains closed until the train reaches the crossing and opens the circuit, thus keeping up the ringing until the train gets there, without regard to the length of time occupied in traveling from the ringing point to the crossing. We describe the apparatus for a single track road. On a track where trains all run in one direction less complication is necessary.

Fig. 1 shows the details of the pneumatic track instrument. The lever *E* upon being depressed by the wheels of a passing train forces downward the piston *B*, moving in an air chamber *D*, sending an impulse of air through pipe *C*, which forces upward the piston *A*, fig. 2, moving in cylinder *G*, and communicates motion to springs *d* and *d'* of the circuit-closing apparatus which is fixed near the track instrument. The piston *B* and lever *E* (fig. 1) are returned to their normal position by spiral springs *F* and heavy rubber car springs *F'*, the latter spring preventing the moving of the lever by a weight less than that produced by the pressure of a car wheel. Check valve *W* (fig. 2) allows the pipe to fill with air after each depression.

Fig. 2 shows the details of one type of the interlocking instrument, with circuit closing device attached. In the illustration the impulsed air from the track instrument forces up valve *b*, which instantly closes, confining the





Profile and Plan of Part of the Line of the Costa Rica Railway.

slightly compressed air under piston A, forming a cushion and retarding its too rapid descent. The duration of the fall of the piston can be regulated by the fit of the piston in the cylinder. A cushion of air is also formed over the piston A above the opening V, thus avoiding injurious contact with top of cylinder.

The interlocking instrument consists of a main electromagnet H and its armature g, an unlocking electromagnet N with its armature m, a locking lever P and a circuit controlling lever J. To the fulcrumed end of lever J is attached an arm which, when J is pushed up by A, throws lever P outward, releasing locked armature g. The arm fixed to lever J also controls spring contact k.

Now, supposing it is desired to operate a crossing signal on a single track road, one track instrument and one circuit closer (that is, the apparatus shown in the lower part of fig. 2) are placed about 1,000 ft. each way from the crossing, and one track instrument and one interlocking instrument, as shown in fig. 2, at the crossing. Each track instrument is connected to its circuit closer or interlocking instrument (which may be placed in a box secured to a post or telegraph pole near the ack instrument) by a ⅝-in. pipe.

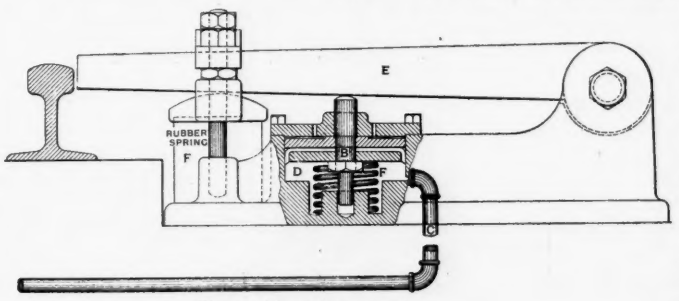


Fig. 1—Track Instrument.

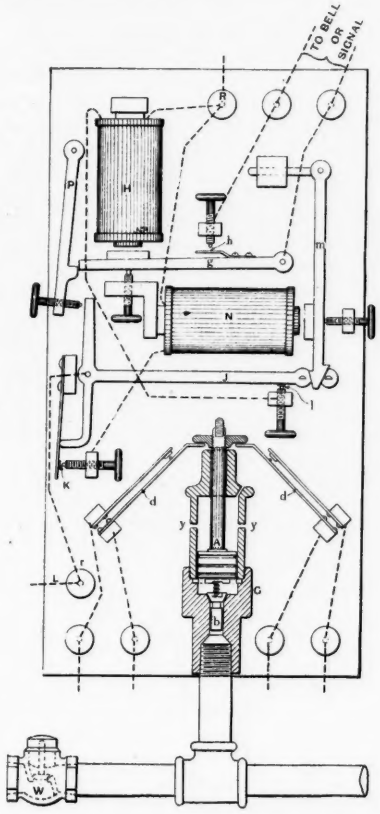


Fig. 2—Interlocking Relays.

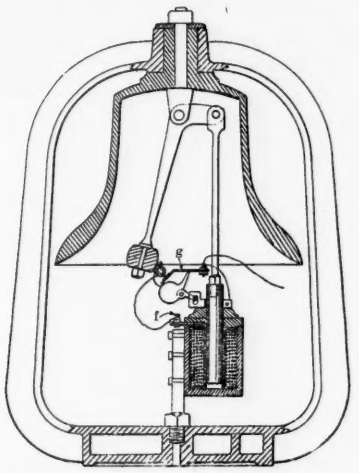


Fig. 3—Bell for Highway Crossing Signal.

Slater & Barnes' Highway Crossing Signal.

As the lever of the first track instrument is depressed by the wheels of a train it works a circuit closer which closes a circuit extending to the crossing. This circuit enters the relay box (located at the crossing) at L (fig. 2.) This energizes electromagnet H, the current passing through circuit controlling lever J, electromagnet H and to battery and ground at binding point R. Armature g is attracted, and electrical contact made at h which closes a local circuit operating the signal. Armature g is held in contact at h by lever P until the lever of the second track instrument is depressed when piston A is raised, throwing up lever J, which interlocks with armature m, and is held up by it. Armature J throws off lever P, and breaks contact at h, and stops the bell. It also permits contact at k until the lever of the third track instrument is depressed, which again closes the overhead wire and energizes the electromagnet N. (The wire entering at L is a branch of the line wire, and the latter extends to both the first and the third track instrument.) The current having been changed to go through N by the altered position of lever J, armature m is attracted, allowing lever J to drop to the second notch, where it stays until the rear of the train passes the third track instrument, when the line circuit is opened. Armature m is released, and lever J drops to its normal position ready for a second operation from a train in either direction. The lever is held up by m until the train has passed the third track instrument, because if it were allowed to drop so as to close l, electromagnet H would be closed by the departing train, and the bell would ring indefinitely. While the train is passing from the second track instrument to the third, the contact at l is open, but that at k remains closed.

If it is desired to dispense with the interlocking instrument and use the track and contact instruments only, to announce the approach of a train to a signal cabin station or road crossing, the piston of the contact instrument can be so adjusted as to permit of a short contact of five seconds or a long one of one and a half minutes, and cause the bell to ring for that length of time after the train has passed the track instrument.

Fig. 3 shows the details of an electric crossing bell. The bell proper is the usual locomotive pattern, set in a suitable iron frame. The magnet is a combination of electromagnet and solenoid. The movable core is attached to and actuates the clapper. The magnetic field of the solenoid is so perfect as to permit of a long and strong pull on the armature core and cause the clapper to strike the bell very forcibly. Six cells of Leclanche battery are sufficient to operate the bell.

The wire connections are made through the automatic circuit closing device g, and binding parts f. Where compressed air is available, a pneumatic bellringing mechanism is used, and is attached to the posts on the bell frame in place of the electromagnet. Only one cell of battery is needed with this.

There are eight pneumatic and ten electric bells in use on the Southern Pacific Company's lines, for protection of road crossings at various points, mostly in the vicinity of San Francisco and Oakland. Some of these bells have been in constant use for over two years, and have given perfect satisfaction as regards reliability and economy. In fact if there is ever a failure to give an alarm, the trouble is to be looked for in the battery or line rather than in the bell. Twelve of the track instruments are in use at various points in California in the operation of tunnel signals and annunciators and for other purposes. Others have been ordered to be installed in new work and in place of existing rail circuit apparatus.

The makers claim for this device that it is strong, compact, durable and reliable. The track instrument does not stand above the top of the rail, and can be placed in streets, and not interfere with horses and vehicles. There are no underground wires with the consequent liability of breakage or leakage, and it requires no expert attendance to maintain the apparatus. The use of this device, with all wires insulated and overhead, with good batteries and connections, will insure reliable operation. Messrs. Slater & Barnes have an audible (whistle) signal that can be placed 500 or 1,000 ft. from the visual signal and so electrically connected with the signal and track instrument as to blow if the signal is at danger, during the time the train is passing it, and so warn engineers that the signal they are approaching is at danger. This electrically controlled whistle valve is covered by a patent issued May 26, 1891.

Maintenance of Railroads in California.

One of the local scenic routes in California is the South Pacific Coast (narrow gauge) Railway, extending from Alameda, on the easterly side of the bay, opposite the city of San Francisco, southwardly through the Santa Clara Valley and over the Santa Cruz Mountains, through forests of giant redwoods, to Santa Cruz on Monterey Bay, a distance of 77 miles. This road through the mountains was very costly to construct, having numerous bridges and 2.8 miles of tunnels, two of the tunnels through the "double summit" of the Santa Cruz range being respectively 1,16 miles and 1,05 miles in length.

This is one of the roads which the representatives of the anti-railroad sentiment, recently testifying before the California legislative committees, thought was earning too much money, and that, although operating in competition with the water craft plying in San Francisco Bay and with the Pacific Ocean steamers between San Francisco and Monterey Bay, the revenues of this line ought to be reduced. Fortunately for the owners, the legislature seems disinclined to act in the matter, leaving the road free to contend with its water competitors and adverse physical conditions in its mountain section. Against the latter, it has, since Dec. 28 last, been carrying on a rather ineffectual contest; the road having, since that date, been closed against traffic by a landslide at the end of one of the summit tunnels, and the present indications are that the traffic cannot be resumed much before the 15th or 20th of this month.

The line, approaching this point from the north, runs up the narrow cañon of Los Gatos Creek, crossing from the easterly side of the cañon 40 ft. above the creek bed, and enters the tunnel on the west side of the cañon. The tunnel at this point was driven about 200 ft. through a clay bed, which apparently rests upon an inclined bed of rock sloping toward Los Gatos Creek. There has always been more or less difficulty in maintaining the tunnel at this point, but since the construction of the road, in 1880, it has been accomplished without interruption of traffic.

From some cause, during the storms of this last winter, water in a considerable quantity has evidently found its way between the clay and underlying rock stratum, and in consequence the clay has commenced to slide slowly in a general direction at an angle of about ten or fifteen degrees from the centre line of the road through the tunnel. Following along the same direction, the earth and loose rock forming the side of the mountain above the clay has broken away, the surface of the slide having an area of between two and three acres, and the loosened material aggregating a little less than 200,000 cubic yards. Several attempts have been made to reopen the tunnel through the clay, but the heaviest timbering possible, whether put in with lagging or so placed that the clay between the timber "sets" could be constantly worked out, has proved inadequate to maintain the opening. A large portion of the material above the clay has already been moved, and the work is now being directed toward making an open cut through the clay and loose materials above it to the bedrock on which it is moving.

The Vortex Blast Pipe.

The English House of Lords, sitting as an appeal court, has recently defined the law as to the liability of railroads for fires caused by sparks from their locomotives. The case was raised by a Port-Glasgow Sailcloth Company against the Caledonian Railway. The fire, which involved $60,000 damages, was caused by a spark emitted from a locomotive on the Caledonian, but the Lord Chancellor, in giving judgment for the railway, laid it down that the railway, having statutory power to run along the line with locomotives, which are apt to discharge sparks, it was necessary to prove that the power given was not reasonably and properly exercised, and this the Sailcloth Company had failed to do. The mere fact that the fire was caused by the spark did not involve liability; the point really was whether the railway had, as was their bounden duty, used the best practicable means, according to the then state of knowledge, to avoid the emission of sparks. The Sailcloth Company failed to prove to the contrary. The offending locomotive, No. 85, belongs to a type adopted in 1888. Prior to 1882 the engines of the Caledonian Company were fitted with a spark-arrester—a grid in the uptake or funnel to prevent embers escaping with the exhaust steam. The new type, on the other hand, has the vortex blast and not a spark-arrester. It was contended in evidence in support of the greater efficiency of the new arrangement, that in the old arrangement the lower tubes got blocked up and required a greater draft in the upper tubes to maintain the steam-raising power of the boiler. Consequently the spark arrester was required, owing to the enormous increase of draft. With the vortex blast arrangement, on the other hand, the draft is more equally diffused. The consequence is that, as the lower tubes do not get blocked, combustion is more complete, and it is alleged fewer embers are likely to leave the firebox. It was therefore held by their lordships that the modern engine, even without the spark arrester, was more efficient than the earlier type with the spark-arrester. As to the contention that an extra precaution might have been taken by adding the spark-arrester, even in the vortex blast engine, there was conflict of testimony as to whether this would not militate against the other advantages mentioned, while the necessity was not clearly established. The Lord Chancellor also admitted that negligence or carelessness on the part of the engine-driver would involve the liability of the railway; but the fact that sparks issued from the stack did not indicate negligence or carelessness. On the other hand, the engine-driver was proved to be an experienced man, and there was no suggestion why he should have departed on this occasion from the ordinary mode of working the engine. The five lords sitting on appeal all agreed in the decision in favor of the railway with costs.

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The method of placing the draft rigging in the same horizontal plane as the sills (illustrated on page 184 of our last issue) is one of the most important and radical improvements recently made in freight car construction. While the disadvantages of the usual mode of placing the draft rigging below the sills have been obvious for many years, the difficulties attending any alteration were sufficient to prevent any effort to effect an improvement. Any alteration in freight cars affecting the dimensions of fixed structures on the road must be undeniably important to warrant opening up such a settled question as the height of freight platforms. But when the heights of freight delivery platforms were compared with the standard it was found that owing to the continual raising of the tracks by tamping and working upon them and to the settling of the platform, the new low cars were nearer the existing platform height than were the older and higher cars. Freight handlers, for this and other reasons, such as loading into wagons, prefer the lower cars. The improvement was so manifest and the demand for cars with both greater capacity and stronger draft rigging so urgent that it is not surprising that at last a departure has been made. It appears to have been very successful; the cubic capacity of the car is increased by the addition made to the internal height, the construction is simplified, the number of parts being reduced; while the material being arranged in a stronger form, as the buffing and drawing strains are taken directly in line with the greatest resistance, the repairs are not so frequent or serious. So many improvements in car construction and appliances have recently become firmly established practice that it will not be surprising if a further radical departure is made, and draft gear is within the next few years very generally placed in the same line as the sills. This change was discussed in some detail in the *Railroad Gazette*, Jan. 2, 1891.

The irrigation boom in the arid lands west of the Rocky Mountains appears to have been rather overworked. A great number of stock companies have been organized with large capital and very seductive prospectuses setting forth the vast amount of territory which is now unproductive in consequence of want of water and the advantages which will result from a regular supply of water to them. Large reservoirs have been built in the mountains, many miles of canals have been constructed and are now in course of construction, and in several instances tunnels have been run through mountain spurs to convey the water to tracts of land which are susceptible of cultivation and must prove very productive if they are supplied with moisture. Instances are not wanting, however, of companies, which, having expended all they could beg or borrow on the capital stock and bonds, have succeeded only in being able to deliver the water, but have not money enough left to buy up the land which is to be so productive, nor are they able to induce the owners of the land to take the water at the price at which it is offered. Several large enterprises of this kind have been already virtually abandoned by the projectors after the expenditure of great sums of money, and it is not easy to see how a number of others which are under way can be made remunerative. A cursory examination only of some of the works which have been undertaken and partly carried toward completion is sufficient to show that more enthusiasm than engineering skill has been exercised in planning them. This is by no means true of the majority of cases, as there are a great many of the works which have been well designed and well executed. The demand for this class of work has given employment to a considerable number of civil engineers, and the new problems presented have created a good deal of enthusiasm among the members of the profession who have been engaged in their solution. So great a number of engineers have been employed on works of this class that they have found it desirable to form a society of their own. Recently a convention of members of the American Society of Irrigation Engineers was held at Denver with great success, and brought out exceedingly interesting papers and discussions. The number of new enterprises which have been put on foot quite recently makes it probable that the members of this society will have abundant employment for a few years at least, but, as before stated, there are already indications that this kind of work will be more profitable to the engineers and contractors than to investors. It is a good thing no doubt to make a blade of grass grow where none would grow before, but it may be that it will cost a good deal more to water the grass than will pay interest on the watered stock of the companies.

The Chicago Railroads and Their Men.

The railroads doing business in Chicago have taken action which in many respects is more radical than anything they have done for years. They have unanimously agreed on a plain and definite course in dealing with the uneasy switchmen who have done their best to keep things in a ferment there for months, and who have been a source of worriment for years. In short, the roads have done just what the press dispatches say they have done; they have authorized the General Managers' committee to conditionally engage men to do the yard work in case of a strike, and have agreed to pool their losses in case a strike occurs An officer of a prominent road and of the General Managers' committee confirms, in all essential particulars, the statements to this effect published during the past week. The reporters will no longer need to talk about the great things that are just going to be done by the switchmen, as an important thing has now actually been done—by the other side.

There are about 2,200 brakemen and conductors engaged in yard work in and around Chicago, and the roads have made arrangements with over 1,500 qualified men who are ready to go to work on call. This is the meaning of the employment agencies that have suddenly appeared in six or eight Eastern cities. The switchmen appreciated this fact, and so when they received on Friday a firm answer to their request for higher pay, they were evidently a good deal sobered. The statement of the roads was convincing, even if it had had no backing of heavy artillery, for it showed that the pay on the Chicago roads was uniform, that it was as high as anywhere else and higher than in many localities, and that the profits on railroad business were decreasing. But however this may be, the switchmen voted on Sunday not to strike, and on Monday sent an unqualified answer to that effect. It is true that the switchmen have not been specially aggressive in their talk for a few months past, and have even denied some of the reports that agitation was going on, but it appears that they made a united application for more pay nevertheless.

Public opinion has doubtless had its effect in the matter. One Chicago paper printed a strong yet moderate editorial warning the switchmen that serious interruption of freight (exhibits) for the World's Fair would be an offense that would not be forgotten.

On the merits of the present controversy there is little to be said, for it seems to be admitted that the switchmen get as good pay as any other class of railroad employés. While all may not agree as to the skill required, the degree of risk incurred, and so on, no one denies that the switchmen's wages are so high that any further increase would in equity require an advance in the pay of several other classes, which makes the question a far-reaching one. The power which the railroads have exercised is, of course, great and the public will closely watch them to see that it is exercised justly. Demagogues will, no doubt, be quick to claim that injustice has been done. But the power is no greater than has been heretofore exercised by the switchmen's and other brotherhoods, to the violent injury of the public, and there is this important difference: the power is exercised in the present instance by responsible corporations, which are even more quickly amenable to legal correction than natural persons would be.

The railroads have certainly been too lenient with their lawless switchmen in Chicagoin the past and they have encouraged insubordination and anarchy, in fact, by their timid or selfish attidude toward strikers and threatened strikers. It is notorious that when one Chicago railroad has got into trouble of this kind all the others have left it to "stew in its own juice," when they have not hastened to make what money and other capital they could out of the situation. In this last case they have done simply what they ought to have done long ago, and they will be very weak if they do not stick to their present position. Macaulay says of Queen Elizabeth that "what she gave she gave graciously, and what she held she held firmly," and everyone knows how glorious her reign was and how brilliantly it contrasted with that of James I., who was obstinate when he should have been conciliatory, and weak when he should have been firm. Queen Elizabeth had the secret of all discipline and government. Hasten to anticipate the just wishes of your people, but stand like iron against their follies.

Average Speed of Rapid Transit Trains.

On another page appears a very interesting contribution by Mr. Croes to the subject of the possible speed of rapid transit trains. This is intended somewhat as a discussion of the editorial article on the same subject which appeared in our issue of Jan. 20, page 51, under the title of Maximum Average Speed and Capacity of Rapid Transit Trains. Mr. Croes is somewhat in error in saying that the data published in that article do not appear to represent the average capacity of any existing motor on any road in actual operation. In fact, they do represent exactly the performance of engines on the Chicago & South Side Rapid Transit Railroad. The diagrams given in that article were taken from engines hauling actual trains on a very fast schedule and represented the work that the engines on that road can do every day when properly handled and what is done by them daily in their best runs. A slow engineman cannot get that work out of them, and it is clear that when the average time between terminals is shortened to a point where it requires the utmost pulling power of the engine to give the necessary acceleration, it becomes necessary to save every second of time possible at each stop and during each period of acceleration and of brake application. The ordinary engineman, accustomed to work on an ordinary schedule, has an indefinite idea of what a second of time means, and he has to be drilled to the new and faster service. Generally a new man runs hard and makes up time before nearing the terminal and then slows down to come in on time. But when the service is so fast that there is but little chance to get ahead of time, only the most active enginemen can keep to the schedule.

If Mr. Croes will go to one of the bright runners on the roads which he mentions and encourage him to make the shortest time he can be tween terminals there, he will get results decidedly different from those given on his diagram, provided, of course, that the engines are not loaded to their full capacity. The relation of the load to the acceleration is the foundation of the whole matter. What is being done now on the roads which he cites may or may not be all that can be done with their equipment of engines, but the fact remains that if there was more drawbar pull for the same train there would be greater acceleration, and then his formula would be untrue. He cites engines weighing from 28 to 60 tons. This is quite a range in weight, and should correspond to a wide difference in power; and if the same train were hauled by the lightest and heaviest engines, and the engines were worked to their full capacity, there would be a big difference in the acceleration. The length of the trains given by our correspondent gives no clue to the weights, and perhaps he has not considered the relation of the weight, pulling power and acceleration so for as is necessary to reach a safe conclusion regarding the fastest possible rapid transit schedules.

The 28-mile-an-hour average speed between terminals, which our correspondent discusses, contemplates a distance of 4,600 ft. between stations which was given with the average speed, and a greater increase in the hauling power. What we have said is that, with stations 4,600 ft. apart and a maximum speed not more than 60

miles an hour, and without exceeding a reasonable weight of motor, an eight-car, rapid transit train can be hauled at an average speed of 28 miles an hour between terminals. The motor probably need not weigh more than the largest size mentioned by our correspondent. The eight cars loaded with 100 passengers will weigh 160 tons; add 60 tons for the motor and the total is 220 tons. The problem then is to run 4,600 ft. from a standstill to a stop and wait about 20 seconds and be ready to go again all in 112 seconds. This gives an average speed of 28 miles an hour between terminals.

What is being done now is as follows: About 1,900 ft. between stations; motor, 20 tons on drivers; time from start to start, 86 seconds; weight of total train and motor, 129 tons; maximum speed, 30 miles an hour; average speed between terminals, 15 miles an hour. The unloading of an eight-car train can be done in the same time as a five-car train if the platforms are arranged for eight-car trains, and 20 seconds is enough for the average delay at stations.

A locomotive without a train will accelerate itself to a speed of 60 miles an hour in a very short distance, and the lighter the train in proportion to the pull the shorter will be the distance in which a high speed will be reached. For the rapid transit work in question the whole motor weight would be on the drivers, and there would be either six or eight drivers. An increase of adhesion weight from 20 to 60 tons with an increase of train weight only from 129 to 220 tons would produce surprising results, as the accelerating force depends during the first part of the acceleration period solely on the adhesion. Later in the period it depends upon the admission of steam to the cylinders, and rapid transit motors must always have the best steam governing apparatus that can be devised.

The estimated 28 miles average speed between terminals is of course a speculation as to possibilities of train movement based on what has been done; but actually it has not been done, and Mr. Croes is quite right in saying so; but we are of the opinion that as soon as there is a good piece of straight and level track that will carry a 60-ton motor, steam or electric, with a demand for an average speed of 28 miles an hour, a motor will be made that will haul a 220-ton train at that average speed between terminals with stations not far from one mile apart. It will cost a very considerable sum for coal per car-mile, but that will not prevent its being done, and is outside of the question in discussion. Further, if our correspondent will try his 60-ton motor, if it is a good one, on the lighter trains he has been observing, and push the motor as the motors in Chicago are now pushed, he will make some pretty smart time that will materially change the constants of his formula.

Now about our formula; our correspondent is quite right, our formula is neither correct in principle nor in practice, that is, if the practice is general practice. It is an empirical, approximate formula based on what is now doing in a particular case, and this we said at the time it was published. But, our correspondent's formula is not correct in principle; neither does it give a parabolic curve. The defect in its theory is apparent from an analysis. It may be divided into two parts, for the purpose of discussion, as follows:

$$T^2 = N^2D + \frac{N^2D^2}{12\,000}$$

The first part is the formula of a parabola and for a constant acceleration, and has the same form as the equation for the distance traveled by a falling body in a given time, which is $t^2 = \frac{g}{2}d$. The second part of the formula is a correction, which is variable, and depends upon the distance traveled over, and not upon the velocity. That is, the formula assumes a constant accelerating force for a drawbar pull, with a correction, depending upon the distance traveled and not upon the velocity; and in this is the error, as the variation in accelerating force depends upon the velocity and not upon the distance traveled over. For instance, a locomotive might travel two miles and yet be quite as powerful at a given speed as it was when it started. But a locomotive is not as powerful when it has attained a speed of 60 miles an hour as when moving 10 miles an hour; therefore, any correction to be made from a constant accelerating force should be made on a basis of velocity and not on a basis of distance. All these formulæ are obtained by deductions from results and not from an examination of the theoretical conditions existing at the drawbar of a locomotive. The theoretical formula is somewhat complicated and must be based on the following formula for the accelerating force: $F = D - cDs$, in which F is the pulling force on the drawbar at any speed, s is the speed, D, the drawbar pull at starting and c a constant, depending upon the nature of the valve gear of the locomotive. It would be interesting to have our correspondent deduce such a formula and also change his own formula until it would give the time to reach a given speed or give the speed at a given distance, and then we can compare notes with him. As it is now we can make no comparisons of .846 B^2 and $t = \sqrt[n]{\left(1 + \frac{d}{12{,}000}\right)}\,d$, and therefore we cannot determine how much we differ in statement.

Locomotive Tests on the Chicago, Burlington & Quincy Railroad.

The paper on tests of compound and simple locomotives on the Chicago, Burlington & Quincy Railroad, read by Mr. William Forsyth before the Western Railway Club given in this issue is worth attention. It is a concise statement of several important facts relative to the power and efficiency of locomotives and the resistance of railroad trains. The engines tested were heavy express locomotives. The Baldwin compound 10-wheeler is considerably heavier than the class "H" moguls of the Burlington. When reading the paper and analyzing the results, one must remember that the Baldwin Locomotive Works had charge of their own engine and the Chicago, Burlington & Quincy engines were run by their own men.

The conclusions are of considerable value, more particularly those with reference to train resistance, which corroborate what has been given before in these columns about the proportion of the engine resistance, including head air resistance. In the past we have made several deductions of this kind (see *Railroad Gazette* March 18, 1892), some of which one of our contemporaries has lately copied without giving credit to this journal. The statement that the head wind resistance and internal engine friction up to 60 miles an hour is not over 10.6 per cent. of the whole corresponds with other deductions made by the *Railroad Gazette* from other tests, and is an important fact and one that must give the advocates of petticoats, trousers, and skull caps for railroad trains something to think about.

The following paragraph from the paper is suggestive and is in accordance with the opinions of those who have made tests of internally-fired boilers with long tubes. "The above table shows that the smaller the amount of coal burned per square foot of grate per hour, the greater the evaporation (per pound of coal), and at slower speeds the evaporation should increase. The average evaporation in the above table, 6.5 lbs., is the same as that obtained from the same coal burned in a cylindrical tubular stationary boiler, at a rate of 25 lbs. per square foot of grate per hour. This shows that the locomotive boiler with properly proportioned grate and good draft appliances will burn five times as much coal per square foot of grate per hour with as good economy as the average stationary boiler." This estimate of the increased economical working capacity of the locomotive type of boiler may be somewhat too large, but it is approximately correct. The increased capacity is due largely to the location of the evaporating surfaces, directly surrounding and over the bed of the fire. In general, boilers that have heating surfaces disposed so as to absorb the radiant heat from the fire will work with a greater range of economy.

The method of comparing the economical operation of locomotives by analyzing the indicator cards is a good one, and, as has been shown before in the *Railroad Gazette*, May 29, 1891, will generally give a clue to the causes of differences in the water consumed per horse power by different locomotiues. In this case Mr. Forsyth has been able to show that the results of such analysis corroborates the results given by the measurements of the dynamometer car. It is certainly a fact that if a decided loss is shown on the indicator cards for a given engine, that engine will not be more economical than the engine with which it is compared when an allowance is made for all differences that may exist in the boilers. In this case, the Baldwin engine had more heating surface and a larger grate area, and under comparable conditions the engine should have been the most economical of those tested; but there was a decided loss shown on the indicator cards resulting from various causes, some of which were in the engine itself, and the more important ones are supposed to be found in the way in which the engine was run by the builders. It is expected that these facts will come out in the discussion of the paper, as there is sure to be a lively interest taken by the members, the compound locomotive problem being one quite near to them all.

As an example of what is shown by the indicator cards, the results of the trips of engines Nos. 145 and 82 with 12 cars may be compared. No. 82 used 14 per cent. more water in hauling the same number of cars, the weights of trains being very nearly allke. This 14 per cent. difference is accounted for by the indicator cards, the comparison of the analysis of which shows that engine 82 used 15½ per cent. more steam for the same work.

The lesson which the Burlington road has drawn from these tests is that the Baldwin engine cannot reduce the present schedule time with a train that is in proportion to its weight; that is, when the Baldwin engine hauls a train, the weight of which bears the same proportion to the weight of that engine as the weight of the common trains of 10 cars bears to the weight of the Burlington class "H" mogul engines, it cannot reduce the present schedule time. The conclusion of the Baldwin Locomotive Works from these tests has not yet been given.

The paper shows that for hauling passenger trains and leaving out all fancy measurements the compound locomotive uses 16 per cent. more coal than the simple engines on the Burlington road; but back of all this there are facts given in the paper which redeem the compound locomotive, and therefore these results are not to be taken as proving that compound locomotives in general are inferior to simple engines for passenger service.

The results given in the paper differ so materially from those obtained elsewhere in trials of compound versus simple engines, that it is manifest that in these tests the compound engine labored under some abnormal disadvantages. It would appear that the principal disadvantage was that the engine had considerable difficulty in steaming. As the engine had ample heating and grate surface in proportion to the amount of steam used, it is evident that the means of fully utilizing the heating surface were defective, and as the paper states that some changes were made in the grates and draft appliances. it is probable that these changes were ineffective and that the grates were not well suited for the fuel used. There is no particular reason why a compound should not steam as well as a simple engine, and there are many reasons why it should steam better under equal conditions, and it appears a pity that the trials were not postponed until the larger boiler of the compound had been put in the same state of efficiency as the steam-raising appliances of the simple engines. The fact that a compound with an unsuitable grate gave a bad performance does not condemn the compound principle, which makes no change in the manner of raising the steam. It is manifest that if a compound, or any other engine, is poorly supplied with steam it cannot utilize it economically, but it is by no means clearly shown that in this instance the fault lay wholly in the fact that the Baldwin compound had four cylinders. The contrary may be inferred from the fact that while the boiler pressure should have been higher than that of any of the other engines, the pressure at point of cut-off is expressly stated to have been lower. The pressures were taken every five minutes, whether the engine was running or standing, but probably the actual average boiler pressure would have been even lower than given in the paper, if the averages were based only on the pressures taken while the engine was running, as the pressure when standing could be raised by the blower to that of engines which steamed well.

One lesson, therefore, to be learnt from these tests is that a boiler, grate and draft applitances which generate steam freely are of even greater importance than the compound principle, and that the disadvantages entailed by bad steaming will more than offset any advantages conferred by compounding. The fact that the Baldwin compound suffered from bad steaming is clearly shown by the indicator cards taken from it and shown in fig. 8. The maximum steam pressure even at 20 miles an hour only reaches 152 lbs., while at 55 miles an hour the excessive compression only reaches 150 lbs., and the steam only touches 122 lbs. Unfortunately the boiler pressure at which these cards were taken is not given. In figs. 14 and 15 the cards from the high and low pressure cylinders are not combined in the ordinary method. Were this done, the amount of "drop" or loss of pressure between the two cylinders would be clearly shown, and the apparent increase of pressure between the high pressure cylinder exhaust line and the initial steam line of the low pressure cylinder would disappear. It is, therefore, difficult to learn much from the combined diagrams in figs. 14 and 15 in their present form.

We would advise those who may be inclined to feel elated about the results of these tests of compounds to wait until after the discussion of the subject at th March meeting of the Western Railway Club, as several who have had experience with compound locomotives have promised to "make a few remarks."

The statement of the receivers of the Reading Railroad and Reading Coal & Iron Co. to the court, as of Feb. 20, 1893, may be condensed as follows: Borrowed money secured by collateral, $9,867,347; due for coal, materials, rentals, coupons and wages, $8,595,481, a total of $18.472,828. Against this the receivers have coal, material on hand and accounts for tolls (unavailable) amounting to $9,068,719; also 30 day coal bills and similar accounts representing a total of available assets of $6,711,065. It will be thus seen that the immediate debts exceed the live assets by about $2,000,000, showing a basis for the issuance of receiver's certificates. The amount of coal on hand at the various depots east and west is given as 1,107,839 tons, at $4.50 per ton—$4,985.276, as compared with 565,093 tons (value at $3—$1,687,089) in 1890, and $2,355,000 in November, 1891, the close of that fiscal year. The decided increase in coal on hand is partly accounted for by the purchases of the coal of individual operators and other coal companies under the combination; yet it is in great part an out and out loss, because the company must go on mining if it would continue to have coal to carry, the profit from the coal so far mined but not sold having in the accounts been already credited up. The $9,867,347 borrowed money is covered principally by collateral trust bonds (unissued as to the public and of unknown value) and preference bonds. What to do with this large sum will be one of the problems of the future. From this brief statement it will be seen that the Reading is very heavily involved, and that it will take great wisdom and, more than all else, a good price for coal as well as a long time to extricate the company from its embarrassments. It is fair to estimate that the Reading last year received $3,000,000 more than in 1891 from the sale of its coal, owing to the high prices reached during the autumn. It is acknowledged now by Mr. McLeod that his equipment consisted in part of small and unprofitable coal cars, and that he was otherwise hampered in the economical operation of the road. It is unaccountable that, knowing the condition of the property and the necessity of renewals, the President should not have used his profits in putting the Reading in good order. On the contrary he went into great schemes, which, even if well conceived, ought not to have been undertaken for a long time, or tried to build up an impossible Reading system in New England by spending Reading's needed money for Boston & Maine and New York & New England stocks for control.

Mr. McLeod has been elected President of the New York & New England by an overwhelming majority, but the victory is probably a barren one, so far as legitimate railroading is concerned. The stock closed on Wednesday below 23, and creditors are pressing the company. It is freely charged that McLeod's friends sold their stock as soon as the transfer books were closed for the annual meeting. This is denied, but denials from the same source concerning the Reading company's investments in New England and Boston & Maine stock proved to be deceptive. The much-heralded agreement between the New Haven and the Boston & Maine roads amply binds each not to cross the Boston & Albany in fighting the other. This does not mean much but it looks like a snub to McLeod on the part of his Boston & Maine directors.

Floods have prevailed throughout the Middle States and also in Michigan, Iowa and Nebraska during the past week. The New York Central and the Delaware & Hudson had bad washouts near Schenectady. A bridge of the Erie road at Wellsburg, N. Y., was considerably damaged. The Western New York & Pennsylvania was submerged at Cuylerville. There was much damage in the region of Wilkes-Barre, Pa., and the nawspapers print thrilling accounts of the experiences of railroad men in running locomotives through water 3 ft. (?) deep. Port Deposit, Md., which always has a flood when any one else does, has been submerged twice within a week or two. The railroad station there was crushed by the ice. Electric street railroads were submerged and compelled to suspend business at Wilkes-Barre, Pa., and also in Albany and other cities. The Detroit, Lansing & Northern had a very bad washout on March 11. On the 12th a freight house and several freight cars were damaged by high water at Davenport, Ia. A dispatch from Omaha, Saturday, reported that 30 bridges had been washed away or badly damaged along the Union Pacific in Nebraska, but the importance of the bridges or the extent of the damage was omitted from the statement. The Chicago, Milwaukee & St. Paul lost bridges near Lima, Ia.

The strike of locomotive runners on the Toledo, Ann Arbor & North Michigan road has evidently failed, as the road found new men very quickly. The press reports still refer to "arbitration" and carry the implication that the road must yet yield something, but there is nothing definite on these points. The significant feature of this case was the threatened refusal of enginemen on other roads to move cars coming from the Ann Arbor road. We cannot learn of any actual refusal, but the road took the trouble to get an order from the United States Court at Cleveland enjoining the Lake Shore & Michigan Southern, the Pennsylvania, the Wheeling & Lake Erie, the Michigan Central, the Cincinnati, Hamilton & Dayton, the Columbus, Hocking Valley & Toledo, the Toledo & Ohio Central and the Cincinnati, Jackson & Mackinaw not to discriminate against the Ann Arbor, the order being based on section 3 of the Interstate Commerce Act. We hate to believe that these roads would have been so weak kneed as to refuse freight because their enginemen were sulky, so we must conclude that the injunction was got out merely as a preliminary tonic for their nerves.

Elsewhere we publish a brief account of the plan adopted for establishing deep and difficult foundations for a very large building by the use of pneumatic caissons. This is to be done in New York City by Messrs. Sooysmith & Co., for the Manhattan Life building to be built on lower Broadway. We believe that this is the first instance known of this application of pneumatic caissons. It is a strange commentary on the ignorance of engineering science and art among architects as a body that so important a journal as the *American Architect* expresses grave doubt as to the security of this kind of foundation. The editor fears that the caisson will tilt or move laterally and that there may be doubt of perfectly filling the caisson with concrete. This sounds very funny to an engineer; and Mr. Charles Sooysmith (whom, by the way, the *Architect* confounds with General Sooy-Smith) has endeavored to set the editor's mind at rest by a short elementary statement of the methods used. Meanwhile we would suggest that the editor go to some of the libraries accessible to him in Boston and spend two or three hours reading about the great bridge foundations built in the last 20 years.

The Arkansas Senate has rejected the bill to create a railroad commission. The Kansas Legislature has repealed the law permitting railroads to charge 10 cents excess fare when passengers do not purchase tickets. Kansas papers report that the disagreements between the two houses are so radical that no important railroad legislation will be passed in that state at this session. A bill has been introduced in the New York Legislature to make the rate of fare on the Erie road two cents a mile. In North Dakota it is reported that 13 important railroad bills have been stolen after they were passed by the legislature and before they were signed by the Governor. The Ohio bill for the taxation of sleeping cars has been favorably reported upon.

Taxation of Franchises.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The chief financial officer of a large city very often forgets, in his anxiety to secure a good showing of receipts for his administration, that a very large proportion of the community who do not ride in carriages and pay large taxes need protection as much as or even more than the great contributors to the revenue of the city, and therefore he is often more eager to make a corporation which has secured the right to furnish conveniences to the people at large pay a direct tax into the city treasury than he is to compel them to furnish good accommodations at low rates to the mass of the community.

The Comptroller of the City of New York is very badly affected in this direction, and has expressed his determination to oppose to the utmost any scheme of rapid transit in which the corporation which furnishes the facilities for travel is not compelled to pay a large percentage of its receipts into the city treasury in the form of a direct tax. This is not fair either to the people who are to use the road or to the corporation which is to construct and operate it.

The furnishing of facilities for rapid transit involves enormous expenditure, not merely in procuring rights of way and construction of roadways and furnishing equipment, but also a great and constant expenditure for maintenance and operation of the road, not only in districts where the travel is heavy and the returns large, but also in outlying districts where travel is light and returns small, although the same equipment and same cost of maintenance are required as in the more profitable districts. The capital stock of a company may be watered to an excessive extent and may represent much more than the actual outlay, but the fact is well known that the revenue from any new enterprise is not and never has been sufficient, for a number of years after its construction, to pay even a moderate interest on the actual outlay.

The imposition of an additional expenditure, which does not tend in any way to facilitate the comfort and convenience of the travelers on the road is felt very naturally by the owners of such a road as a hardship, and its tendency is to make them cut down expenses, both of construction and operation, to a minimum, and by this means the comfort and convenience of travelers are decreased, while, on the other hand, the burden upon the large taxpayers, who use the road the least, is not appreciably diminished.

If, instead of undertaking to make a rapid transit company pay a certain proportion of what they collect from travelers into the city treasury, the city authorities would require them to furnish absolutely decent accommodation at stations and on trains, require that a sufficient number of trains should be run to accommodate passengers at all hours of the day, and should limit the fares both as to single rides and by providing commutation rates for tickets sold in larger quantities, the companies would not feel so aggrieved, the public would be better served, and the use of the roads would be encouraged.

ANTHONY OVER.

Brakes on Engine Trucks.

At the last meeting of the New England Railroad Club the President announced as the subject for discussion, "Air Brakes, with Special Reference to their Application to the Front Wheels of a Locomotive."

MR. LAUDER (Old Colony) alluded to the necessity for providing increased brake power for the high speeds at which passenger trains are now run. The prejudice against driver brakes had disappeared and there was really no good reason why the engine truck wheels should be unbraked. Some suggested that as the truck was a leading portion of the train it might be dangerous to apply brakes to those wheels; but the truck of the locomotive bears the same relation to the locomotive and the train that the truck of each individual car bears to the locomotive and the train. The truck under the locomotive is nothing but a four-wheeled truck, swiveling freely on its centre. The entire brake application is attached to the truck, none of it being attached to the frame of the locomotive, the connection between the truck brake and the train pipe being made of flexible rubber hose, while in a car there are connections between the brake and the body of the car which might obstruct the free movement of the truck while the brake is applied; but experience has shown no deleterious effect from the application of the brake to the truck of the car, and there is none when applied to the truck of a locomotive. We have on our road about 15 locomotives equipped with the truck brake, and the retarding power is as effective as on any other part of the train.

The truck wheels are occasionally skidded, and a jet of sand should be applied to them, while Ross shoes should be used to keep the front truck tires in good shape and save re-turning. Front truck wheels are small and wear rapidly, even without the brake.

The flexible connection should not be between the engine triple and the brake cylinder on the truck, for a burst hose will then disable the entire engine brake. The hose should be from the train pipe to a separate triple and reservoir on the truck, then if it bursts it will have no more effect on the brake power than the bursting of an ordinary hose. All the brakes on the train, engine truck, driver, tender and cars should be applied by one handle. If the driver brake is worked by an emergency handle the engineer will forget it in his excitement when an emergency actually arises. The engine brake should be used, but the engine should not be reversed, for that skids the wheels and diminishes the braking power.

MR. MARDEN (Fitchburg) was now using a brake instruction car.

MR. R. A. PARKE (Westinghouse Brake Co.) pointed out that in modern high speed express trains the weight on the engine truck bore a considerable proportion to the weight of the rest of the train. The length of stops with a short train is reduced as much as 100 ft. by the use of a brake on the engine truck. Many railroads are taking the matter up.

MR. LAUDER was about to make some experiments on the subject.

MR. EVANS (Westinghouse Brake Co.): The application of the brake to the front truck gives an additional braked weight of 30,000 to 40,000 lbs. in modern engines, and we have furnished upwards of 50 sets for old engines, and have had numerous orders for new engines.

TECHNICAL.

Manufacturing and Business.

The new factory of the Laidlaw-Dunn-Gordon Co., which is a consolidation of the Laidlaw & Dunn Co. and the Gordon Pump Co., will be located at Cincinnati, and will be one of the largest and best equipped pump and hydraulic works in this country. When the new plant is completed the Gordon Pump Works will be removed from Hamilton to the new works, and the manufacturing department of the Laidlaw & Dunn Co. will be transferred to the new factory. The directors of the new company will be Robert Laidlaw, Walter Laidlaw, John W. Dunn, Thomas McDougall, Alexander Gordon, Robert McKinney, Thomas J. Gaff. The officers will be Robert Laidlaw, President; Walter Laidlaw, Vice-President and General Manager, and John W. Dunn Secretary and Treasurer. The stock of the company will be held by the parties now interested in the two companies.

The Keystone Car Door & Supply Company has been recently organized at Williamsport, Pa., to manufacture iron fastenings, switch blocks, locking and other devices for passenger car doors, patented by C. R. Harris and F. C. Ruffhead. James B. Coryell, of Williamsport, will be Eastern Manager, and C. A. Coxe will have charge of the Western office at Chicago.

The Mechanical Manufacturing Co., of Chicago, has an order from the Terminal Railroad Association of St. Louis for 30 Ellis patent bumping posts with rubber cushion attachment, to be erected in its new passenger station at St. Louis, Mo.

Tinius Olsen & Co., of Philadelphia, have just completed orders as follows: One 100,000 lb. autographic testing machine for the Wm. Cramp & Sons' Ship & Engine Building Co., one of same capacity to the Baldwin

Locomotive Works, one of 300,000 lbs. for the Pencoyd Iron Works, and one of 100,000 lbs. for the West Superior Rolling Mill. The firm has also built one wire-testing machine for the Washburn & Moen Co. and one cement testing machine for the University of Michigan at Ann Arbor, and one for the University of Pennsylvania in Philadelphia. The firm is now busy on machines for exhibition at the World's Fair in Chicago.

The Morgan Engineering Co. of Alliance, O., has just delivered to the new locomotive shops of the New York Central & Hudson River road at Depew, an electric traveling crane with a 68-ft. span, having a capacity of 60 tons.

The Anniston and New Decatur shops of the United States Rolling Stock Company were sold at Birmingham, Ala., to G. W. Ristine, Manager of the United States Car Company, for $150,000, subject to the consolidated mortgage of $1,300,000 which covers the four plants of the United States Rolling Stock Co. Mr. Ristine is quoted as saying that plants at Anniston and New Decatur will be started up shortly, giving employment to about 2,000 men. The sale of the plant at Hegewisch, Ill., will take place in a few weeks and the reorganization will then be carried out.

The Standard Railway Supply Co. has filed articles of incorporation at Elizabeth, N. J. The capital is placed at $50,000, and the incorporators are ex-Congressman Amos Clark, J. H. Alexander, A. L. Clark, Louis H. Brown, Sigourney F. Clark and Howard T. Alexander.

The J. W. Fowler Car Co. of Elizabeth, N. J., has filed articles of incorporation. The capital is $300,000, and the incorporators are J. W. Fowler and John W. Cooper, of Brooklyn, and Ralph C. Swan, of Bayonne, N. J. The company will manufacture railroad supplies and cars.

The New York Central & Hudson River road has ordered brake equipment for 1,100 cars from the New York Air Brake Co. The cars are for service on the Rome, Watertown & Ogdensburg road.

The National Paint Works, of Williamsport, Pa., whose paints have been used on pretty nearly all the large new engineering structures, has recently made the last shipment of an order from the Chicago & South Side Rapid Transit road, which company has used National paints on 8½ miles of its elevated structure. These paints were used on the ironwork on five of the largest of the World's Fair buildings at Chicago and on the 3½ mile extension of the Brooklyn Elevated.

At the annual meeting of the stockholders of the Boyden Air-Brake Co., at Baltimore, it was decided to increase the capital stock $1,000,000, of which $500,000 will be preferred and $500,000 common stock. The preferred stock is guaranteed to pay six per cent. dividends. The directors elected were: George A. Boyden, Charles B. Mann, W. Whitridge, Edwin F. Abell, Douglas H. Thomas, Skipwith Wilmer, Theodore G. Lurman and B. N. Baker.

The new buildings of the Mason Air Brake & Signal Company, at Elgin, Ill., on the land recently purchased at that point, will soon be started up. The dimensions of the five buildings, are as follows: Main building, 100 × 300 ft.; iron foundry, 30 × 100 ft.; brass foundry, 30 × 60 ft; office, 50 × 50 ft., and power house, 50 × 75 ft., with four large boilers. In addition there will be four 80-H. P. boilers and the plant will be lighted by 600 electric lights and heated by steam. The town of Elgin is located on the Elgin, Joliet & Eastern and two of the Chicago trunk lines. The main office will remain at 218 La Salle street, Chicago. The train signal made by the company is in use on the Chicago, Milwaukee & St. Paul road.

The name of the Thomson Hydraulic Company has been changed to the Neptune Meter Company. By this change the company's name embodies the title first given to the meter. The principal reason for the change is that various people have been misled to think that the Thomson Hydraulic Company and the Thomson Meter Company are associated concerns, the fact being that they are entirely distinct corporations, having no common interests. The company announces that it has secured 165 sq. ft. of floor space for its World's Fair exhibit, in the Department of Manufactures, where it will make an exhibit of water meters and other things sold by the company, and where it will also offer to visitors the hospitality of Waukesha water cooled to 40 deg., perfectly pure and accurately measured by the Neptune meter, which is to be used exclusively for measuring the Waukesha hygeia drinking water at the Fair. This water is to be piped from the springs over 100 miles away and to be sold exclusively by meter measurement at 5 cents a gallon. The Neptune Meter Company has contracted to furnish 1,500 meters for this purpose alone.

Mr. Edward Hill, formerly Western representative of the Pickering Spring Co., Limited, of Philadelphia, has been appointed General Sales Agent of this company, with headquarters at 80 Broadway, New York City. J. C. Halladay succeeds Mr. Hill as Western representative, with office at 719 Phenix Building, Chicago.

New Stations and Shops.

The Berlin Iron Bridge Co., of East Berlin, Conn., has secured the contract for the new buildings required by Wm. Cramp & Sons' Ship & Engine Building Co., of Philadelphia. The Berlin Bridge Co. has lately completed a boiler shop for the Cramps, and now has a contract for the other buildings required to enlarge that plant. The new buildings will consist of a shipshed 60 ft. × 100 ft., a blackboard 75 ft. × 200 ft., and a bending shed 86 ft. × 150 ft., construction throughout of iron.

The Berlin Iron Bridge Co. has just completed a power station 38 ft. wide by 112 ft. long for the Roaring Fork Electric Light & Power Co., at Aspen, Col.

The Gulf, Colorado & Santa Fe is constructing a ten-stall roundhouse at the yards in Galveston, Tex. A car shed, 200 × 42 ft., is also being built.

The St. Louis Merchants Bridge Terminal Railroad Company is reported to be working on plans for a station in St. Louis, to be erected at the junction of Broadway and Third street. The building will cost over $500,000, exclusive of the cost of the land.

The West Virginia & Pittsburgh road will build repair shops to cost about $40,000 at Weston, W. Va. The company's roundhouse at that point will also be enlarged. The plans for the new buildings have been prepared and favorably acted upon by the directors of the company and work will begin within a few weeks.

A. & P. Roberts & Co., Pencoyd Iron Works, Pencoyd, Pa., are erecting a new foundry 80 × 42 ft. in size, one story high.

The New York & New England has secured authority to build a temporary frame station at Hartford, Conn., to be covered with iron. The structure is to be removed in three years.

The contract for erecting the new union station at Portland, Or., described last week, has been let to Robert Wakefield, of Portland. The structure will cost $400,000 and will be built of pressed brick with stone trimmings. It is 516 ft. long, three stories in height, with a handsome clock tower, and will be finished in hard wood. It will be completed by Aug. 1, 1894.

Pintsch Gas.

The following statement has been furnished to us of the number of cars equipped with lamps and appliances for the use of the Pintsch compressed gas in the United States. The list is made up to March 1, 1893, and includes also ferryboats and steamboats, which have been reduced to an approximate equivalent in cars. The aggregate, it will be noticed, is about 13 per cent. of all the passenger equipment in the United States, including mail and express cars. A list of the plants for manufacturing and compressing the Pintsch gas was given in the *Railroad Gazette* of Jan. 20, page 56:

	Cars.	Boats.
Baltimore & Ohio	20	..
Baltimore & Ohio Southwestern	18	..
Boston & Albany	72	..
Cairo Short Line	3	..
Canadian Pacific	4	..
Central Railroad of New Jersey	253	..
Central Railroad of Georgia	37	..
Chesapeake & Ohio	17	..
Chicago & South Side Rapid Transit	180	..
Chicago & Eastern Illinois	9	..
Chicago & Erie	49	..
Chicago & Grand Trunk	1	..
Chicago & Northwestern	371	..
Chicago, St. Paul, Minneapolis & Omaha	32	..
Chicago, Rock Island & Pacific	71	..
Cleveland, Cincinnati, Chicago & St. Louis	3	..
Cincinnati, Hamilton & Dayton	11	..
Cincinnati, New Orleans & Texas Pacific	18	..
Denver & Rio Grande	84	..
Delaware, Lackawanna & Western	193	..
East Tennessee, Virginia & Georgia	31	..
Hoboken Ferry Company	..	16
Illinois Central	20	..
Lehigh Valley	2	..
Lake Shore & Michigan Southern	119	..
Long Island	1	..
Louisville, New Albany & Chicago	13	..
Missouria, Kansas & Texas	19	..
Missouri Pacific	74	..
New York & New England	12	..
New York Central & Hudson River	327	..
New York, Lake Erie & Western	373	8
New York, New Haven & Hartford	141	..
New York, Providence & Boston	27	..
Old Colony	106	..
Philadelphia & Reading	109	..
Providence & Stonington S. S. Co.	..	4
Pullman's Palace Car Company	516	..
Richmond & Danville	5	..
Rome, Watertown & Ogdensburg	11	..
Southern Pacific	3	..
Union Pacific	32	..
Wabash	40	..
Wagner Palace Car Company	387	..
West Shore	119	4
	3,989	32
Boats, equivalent in cars	132	..
Total cars	4,181	..

Interlocking.

The Chicago & South Side Rapid Transit is making arrangements for a complete system of interlocking for its Jackson Park line. Towers will be erected at the terminals, yards and at points where express trains will overtake locals. Contracts are to be let immediately, and the work pushed to completion as rapidly as possible.

The Railroad and Warehouse Commissioners of Illinois have granted permission to the Chicago & Western Indiana to run trains over the crossing at Burnham without stopping, the required safety appliances having been put in.

A Big Coal Dock on Lake Superior.

A company has been formed with a capital of $1,000,000 to build a coal dock on Allouez Bay, which is part of the Bay of Superior. The dock when completed will be 3,000 ft. by 500 ft., or the largest coal dock in the world. It will have an ultimate storage capacity of 1,000 000 tons and an annual handling capacity of nearly 2,000,000 tons. The portion to be built in the summer of 1893 will have a storage capacity of 300,000 tons and an annual handling capacity of 600,000; the intention is to complete the dock in 1894. Of course the necessary railroad connection will be provided. The officers of the new company are: E. N. Saunders, President; C. J. A. Morris, of St. Paul, Vice-President and Chief Engineer, and E. L. Shepley, of St. Paul, Secretary and Treasurer. The new company will be closely allied, it is supposed, with the Northwestern Fuel Co., some of the officers being the same in both.

The Vienna-Buda-Pesth Electric Railroad.

Concerning this other 100-miles-an-hour electric railroad which has been considerably talked about, the *Journal des Transports* says that the execution of the project will undoubtedly be delayed a good while. It is estimated that the cost of the line, 240 kilometres, will be from 300,000,000 to 350,000,000 francs, or in American equivalents from $400,000 to $467,000 a mile. The *Journal* adds that it is estimated that the number of travelers between Vienna and Buda-Pesth annually is 200,000, and that while fast electric trains would certainly increase the travel it is difficult to see how interest on first cost could be earned. We should say so.

Harbor Works at Venice.

The new works for the reopening of the port of Lido (Venice) began several years ago. Owing to the construction of breakwaters a channel has been cut by the current through the bar about five metres deep at low tide and of a breadth varying from 100 to 250 metres. Although the works will not probably be completed before 1895, it is expected that next year the Lido port will be rendered navigable for the largest vessels. Two large Italian merchant steamers and an English steamship have already gone out of the port at high tide in charge of pilots. The estimate of the expenditure is £240,000, but it is expected that a much larger amount will ultimately be laid out by the Italian Government.

The Block System on the New York, New Haven & Hartford.

In about two months this road will be equipped with block signals, with Sykes locks, all the way from its western terminus at Woodlawn, 12 miles from the Grand Central station, New York, to Providence, R. I., 175 miles, a contract having been given to the Johnson Railroad Signal Company, of Rahway, N. J., to equip the Providence Division, from New London to Providence.

The interlocking and block signals on the New London (Shore Line) Division, which have been in course of construction for several months, will be ready for use about April 1. They extend from Leete's Island eastward to New London, 38 miles. The signals were put in by the Johnson Company, and the system is more complete than that on the New York Division, which was put in some four or five years ago. On the Shore Line Division all switches are provided with interlocked signals, even those in isolated locations. Each station is fully equipped, after the well-known English fashion; that is, each main track has a home signal to protect the switch or switches, a starting signal, beyond all the switches, and a distant signal, interlocked with these two. West of Leete's Island the work of altering the location of the line and constructing the second main track is not yet finished, and the signals have not been put in, but east of here there are towers, controlling switches, at Leete's Island, Guilford, Madison, Clinton, Westbrook, Saybrook Junction, Lyme, South Lyme, East Lyme, Waterford and New London yard. Sykes locks and the bell-code are used, and the work can all be done without the aid of Morse operators. There is one railroad crossing, that of the Valley Division at Saybrook Junction, and four drawbridges, one at Lyme (Connecticut River), one at East Lyme and two at New London. These points are protected by derailing switches. The work west of Leete's Island is nearing completion, as far as East Haven, and the double track will be in use on the whole of the New London Division, except the one mile west of East Haven, about May 1.

On the Providence Division the signal arrangements will be in general the same as those on the New London Division just described. The Providence Division now has clockwork track-circuit signals at several stations, and also continuously for a few miles near Providence, and the same near New London.

A New Nickel-Steel.

A new nickel-steel, the secret of the manufacture of which has been secured by Krupp, of Essen, has been experimented with at Meppen. Two 3.4-in. shells, each containing 6 oz. of picric acid, were placed, one in a gun of ordinary Krupp steel, and the other in a gun of the new nickel-steel, at a distance of 12 in. from the muzzle. Upon the shells being exploded, the muzzle of the gun of ordinary steel was blown into a number of pieces, but the only effect produced upon the nickel-steel gun was a local enlargement of the bore to the extent of ¼ in. In the next experiment a 3.7-in. shell, containing 6.3 oz. of picric acid, was burst in a nickel-steel gun at a point 19.5 in. from the bottom of the bore. The results were an enlargement to the extent of ⅛ in. and a fissure 3 in. in length. Trials of plates of this nickel-steel have also been made and have given satisfaction. This steel, being hard and proof against impact, should be suitable for tires, axles and crank pins.

Electricity in Chain Towing.

An interesting application of electro-magnetism has recently been made in France in the industry of chain towing, which is extensively carried on on some of the large European rivers. The several turns of the chain on the towing drum necessary to get the proper adhesion has been the chief cause of deterioration and rupture, and this fact, together with the difficulty of properly paying out the chain in rounding bends, especially

where it is used in ascending the stream only, has directed attention to improvement in these matters. The experiments conducted by the Société de Touage de la Basse Seine et de l'Oise upon the river Seine have culminated in the construction of a large tow boat, whose towing apparatus contains several magnetized pulleys. The main towing pulley is but a little over 4 ft. in diameter. It is simply a solenoid, whose soft iron coil is flanged to form the groove, the bottom of which is a bronze ring with rubber joints to prevent the wire coil from getting wet. The current is generated by a small dynamo. The whole construction is simple and very strong, and besides the advantage of having a small towing pulley there is the much greater one that the proper amount of adhesion is obtained with only three-quarters of a turn. A similar magnetized pulley acts as a brake on the slack of the chain, enabling it to be properly and regularly paid out. It is hoped that these improvements will render chain-towing practicable on rivers when the rapidity of the current or the crookedness of the stream has hitherto prevented its adoption.

Nickel Steel for Boilers.

It has been reported that the Detroit Dry Dock Company, of Detroit, Mich., intended to use nickel steel for boilers. The company have been endeavoring to get information touching on the question of nickel steel and its uses, particularly for boiler purposes. They have canvassed the necessary ground to reach a decision in regard to its use in marine boilers, but thus far have found it very difficult to secure any reliable statistics. They have secured some prices, which have not encouraged them to consider the matter further as the steel at present is too expensive for such use. The reason for considering the matter was a desire to decrease the weight of boilers, or with the same weight of steel, as is now used, to be able to carry higher boiler pressures.

Canal Improvements in New York.

Governor Flower has signed the bill appropriating $258,000 for canals. Of this amount $10,000 is appropriated to enable the Superintendent of Public Works and the State Engineer to conduct with all reasonable dispatch such experiments as may be necessary to determine whether electricity can be effeetively and economically applied as a motive power on the canals. They are to report their conclusions to the next legislature. The bulk of the appropriation is for increasing the lockage capacity of the Erie canal and for improving that canal, with the Oswego, Black River and Champlain canals.

THE SCRAP HEAP.

Notes.

The state of Minnesota will receive from the railroads in taxes on their gross earnings for 1892 about $1,250,000.

The shops of the Laconia Car Works, at Laconia, N. H., were damaged by fire last week to the extent of $25,000.

The Old Colony has established a system of watch inspection, the chief inspectors being Wilson Brothers & Co., of Boston.

Emmett Dalton, the train robber, who has been convicted of murder in connection with the Coffeyville raid, has been sent to prison for life.

The Women's Union of Philadelphia has sent a formal petition to the Pullman Palace Car Company requesting the abolition of smoking compartments in palace cars.

The block system on the New York Central & Hudson River road is now in operation throughout the Hudson River Division and also between Albany and Schenectady.

The Denison Compress, at Denison, Tex., was burned on March 13, with about 900 bales of cotton and 20 cars The compress belonged to the Missouri, Kansas & Texas Railroad. The loss is about $150,000.

Yardmaster Rupp, charged with causing the West Manayunk collision on the Philadelphia & Reading last October, has been acquitted by a jury at Norristown. This collision and Mr. Rupp's connection with it were discussed in the *Railroad Gazette* Nov. 4 and 11.

Ohio papers are publishing the name of a member of the legislature who lent his railroad pass to a friend and got found out. The friend did not succeed in impersonating the representative with proper "tact" and was compelled by the conductor to give up the pass.

The London & Northwestern locomotive and cars for exhibition at the World's Fair arrived in New York last week and have gone to Chicago over the New York Central and the Lake Shore. The same ship also brought the whole exhibit of the London & Northwestern, including full-sized models of the "Rocket" and the "Dreadnaught."

The New York *Herald* has printed a column story about the applications of the General Manager of the New York & South Beach Railroad for annual passes in exchange for beautiful passes of his own "printed in chocolate colored ink on a bluish green ground," which he sent out. This company has any number of directors and other officials, but no railroad.

The passenger station of the Philadelphia & Reading at Ninth and Green streets, Philadelphia, which will soon be abandoned, has been in use since 1848 with little change except the re-building of the roof in 1864. The land was bought in 1846 for less than $6,000. The Philadelphia & Reading took possession in 1870, the name of the road before that being the Germantown & Norristown.

The large number of heavy cars now required to transport a moderate number of passengers, and the consequent diminution of the profits of passenger trains, are well illustrated in a recent item from a Pittsburgh paper, in which it is stated that train No. 9, of the Pennsylvania road, filled with people returning from the Presidential inauguration, consisted of six sleeping cars, six day cars, one dining and one baggage car; but that the total number of passengers was 265, equal to only 19 passengers per car hauled. The statement of the reporter that the train was "loaded to the roof" must be regarded as slightly figurative.

World's Fair Notes.

Three Kreibiel anti-telescoping cars have arrived on the grounds. They are drawing room parlor cars.

Collector of Customs Clark recently added 18 men to the corps of inspectors at the World's Fair ground. There are now sixty or seventy inspectors on the grounds looking after the exhibits as they are unpacked.

The Imperial Japanese Commissioner states that his government desires to make a naval exhibit in the Transportation Building. The exhibit will comprise models of Japanese men-of war, guns of various descriptions, projectiles, munitions of war, naval charts and plans of naval vessels. In response to the request space will be allotted the exhibit on the east side of the building south of the golden door.

All but four of the Chicago terminal lines have now signed the agreement to establish a "Bureau of Information" at the Exposition Grounds, and these four, the committee thinks, will soon become a party to the agreement. The three principal lake lines have also agreed to join. A meeting of those who have signed was called for Tuesday, March 14, to elect an Executive Committee for the management of the bureau.

The extensive exhibit of the Baltimore & Ohio road, recently described in the *Railroad Gazette*, is to include a very full collection of photographs of "royal trains." A Baltimore paper states that the gallery surrounding the large space occupied by this road will be filled with these pictures. The trains illustrated will be those of the Emperor of Germany, the Czar of Russia, Queen Victoria, the Prince of Wales and many others, including specimens from India, South America and other parts of the world.

The Chicago, Milwaukee & St. Paul has prepared plans for a station to be built at Kinzai street, Chicago, and will land suburban passengers there during the World's Fair. The Union station, at which passengers are now landed, is deficient in capacity for handling large crowds. The Chicago, Burlington & Quincy, the only other road entering this station which does a large suburban business, has been considering the matter of landing suburban passengers at Harrison street, but has decided that it will not be necessary.

The Great Western locomotive Lord of the Isles, an English locomotive, is being erected in the Transportation Building. It was brought over in sections and is being put together under the direction of a couple of Englishmen. It was built in 1851, by the Great Western, at their Swindon shops, as an exhibition engine for the World's Fair of that time. It has one pair of drivers 8 ft. diameter. There are two pairs of leading wheels and one pair of trailers, whose diameter is about 4 ft. 6 in. The frame is outside of the wheels and inside cylinder.

Exhibitors on Midway Plaisance are protesting against the building of viaducts over the Plaisance by the city. These viaducts were thought necessary by the city authorities as the only means of affording adequate protection from fire to the part of the city lying immediately south, and they were intended only for the use of fire engines. The plea of the exhibitors is that the erection of these viaducts will destroy the artistic effect of their structures. It is probable that the viaducts will be built, as the only alternative proposed is to place gates at these thoroughfares with guards stationed to open them if needed, and this appears to be hardly feasible.

The State Engineer's Department is constructing a relief model for the Chicago Exposition of so much of the State of New York as will show the Erie Canal, with its feeders, and the Champlain Canal. This map will he 50 ft. long and 15 ft. wide. Its scale is two inches to the mile horizontal and one inch to 60 ft. vertical. This will, is said, be the largest relief map ever made, and is constructed by Mr. Leutze, who made the relief map of Florida which was shown at the New Orleans Exposition some eight years ago. The large scale adopted allows very full details to be displayed. One of these shows that Oneida Lake is 78 ft. lower than the Erie Canal, which advocates of the Niagara Falls and Oswego route for an enlarged waterway propose to use to feed that waterway.

A big gun has been received at Jackson Park from the Watervliet Arsenal and will be installed in the Government Building. It is 36½ ft. long and weighs 58 tons. It is a 12-in. breech loading steel rifle and throws a projectile weighing 1,000 lbs. A charge of 460 lbs. of powder is used. The gun has never been tested, but a companion gun of its size has been tested at Sandy Hook, N. Y., several shots having been fired from it. In the transportation of the cannon from Watervliet to the Fair Grounds a specially constructed twin car was required, each car of which was 70 ft. long, with two six-wheel trucks. The wheels were of steel and each was provided with a brake. The cannon rested on a truss, the centre of which was over the coupling of the cars. By means of hydraulic jacks the cars were unloaded and sent east to be used to carry the Krupp gun that is on its way to the Exposition.

The Elevated Railroad in Cleveland.

From the best information that we can obtain the report of this project is a "fake." No company has been organized and no citizen of Cleveland has been found who has any knowledge of the enterprise. The person who worked the daily papers is a resident of a neighboring village, and his motive appears to have been to boom real estate.

Iron and Iron Ore Notes.

Pig iron production is again increasing, the furnace capacity on the first of this month having been 77,210 tons per week, a capacity which has not been exceeded since April 1 of last year. This increase in production has been made in the face of about the lowest prices so far accepted in this country. The Thomas Iron Company has made contracts for deliveries through the year at $15 for No. 1 anthracite, which averaged $15.75 for last year, and a large sale of gray forge iron is reported on the basis of $8 at Birmingham. This is 30 to 31 cents below the price of Cleveland No. 3 iron at Middlesborough. The consumption at the prices mentioned seems to keep pace with the production.

The ore and freight situation is unchanged. The accumulation on the Lake Erie docks is moving with considerable freedom, but no sales of ore are reported. Rumors are current of an intention to restrict production with the purpose of forcing up the price, but in view of the fact that the Illinois and Carnegie concerns are not understood to be buying, it looks as if the forcing might be on the other side. In the mean time lake freight rates are unsettled, the vessel men holding off for higher prices than were obtained last year. Everything points to a busy season for them. Duluth is expecting to add nearly 500,000 tons to its receipts of some 1,900,000 tons of coal for last year, as its docks will probably be bare of coal at the opening of navigation, and the probably late opening of navigation is expected to make freights of all kinds very active.

The Verdict of Five Appraisers.

Our Salt Lake friend has brought out another alleged specimen from some railroad's alleged archives. It concerns a "yellow cow," with one of those pedigrees which undergo an instantaneous transformation when the animal is struck by a locomotive.

Dear Sear i have rote yu menny times abut mi cow and now i want to no what you air going to do about her. she was the only soarse for bred and milk for mi 2 childrens and now you have took her out of there mouths if you don't pa me in a weak i will put her in the hands ov lawyers she is a pet ov mi wife that gives 7 qts. of milk at sitting strained you now a cow of that sort is worth something and now I want you too came too time and she was 3 quarters blood. 5 up raisers figgers 44$44 47$47 46$46.

Iron Making at Lake Ore Ports.

Mr. Richard A. Parker, of Marquette, has a long and interesting article in the *Iron Trade Review* on this subject, which is of importance to iron makers and iron users. He maintains that at Marquette the average annual dew point is at 28 and the absolute humidity is 1.83, so that coal can be stored there without prohibitory deterioration, and though coke made there will cost more than at Chicago, the ore, particularly non-Bessemer, will be so much less that the costs will stand as below.

Estimated cost of making one ton of pig iron:

	At Chicago.	At Marquette.
Bessemer	$13.82	$12.40
Non-Bessemer	12.73	11.92

showing a difference of from $1.40 to $1.45 in favor of Marquette. This difference, if found in practice, would give the ore-shipping ports a great advantage in all lake ports and on the lines of railroads leading to the West.

We've Seen His Work on Other Roads.

Mr. Folsom, of the Great Northern advertising department, has received an offer from a St. Louis man, who describes himself as "an author and novelist of some celebrity," to write up the Great Northern system. He says: "I propose to write you an original romance, peopling the forests and scenic wastes along your route with pre-historic heroes and heroines, coloring all with the storms of passion, the sunshine of love and the lightning of dramatic action." But he will not receive the commission.—*St. Paul paper.*

A Vertical Offset.

An ambitious little town in the West that wanted to show that it was on the proper route for a trunk line raised a fund and had a survey made. The engineer in charge found that he could not keep in the valley with the use of reasonable grades, so, when he found that his line was 200 or 300 ft. above the valley, he simply dropped straight down into it and started again. This startling change of level was shown on the profile and the explanation given to the committee was "that it was a vertical offset," which was satisfactory.

The Chicago Switchmen.

The rumors of an intended strike among the switchmen on roads centring in Chicago have been finally quieted. A meeting of the grievance committees, held on the 12th, resulted in an official declaration that the switchmen will take no further action except after reasonable notice to the general managers. The very short strike on the Chicago & Eastern Illinois (it lasted about an hour) was the result of a misunderstanding. The request for an increase of pay was not a "demand" on all the roads, but was made in a respectful manner.

The systematic way in which the General Managers' Association has gone to work to resist any possible demands of the switchmen is shown by the fact that temporary headquarters have been opened in the Rookery and fully equipped with office force, telegraph, telephone and messenger service wires, the intent evidently having been to be in shape to promptly and by concurrent action handle a strike should one occur.

The man who hired men in New York City to take the place of prospective strikers closed up his office on Tuesday afternoon and left. Of the 370 men whom he had selected out of over 800 applicants he paid off 170. To eight who were to be foremen, he paid $10 each, and to the others of the 170 he gave $5 each. The other 200 men had not called when he left. Some of the men engaged in Chicago were paid $32.50 each.

A Traveling Blacksmith.

The Northern Pacific has created a new office, that of "traveling blacksmith," whose duty is to go from shop to shop over the whole system and see that the work is kept up to a certain standard and to encourage uniformity of practice, stop waste and disseminate information pertaining to the business of the shops. Other railroads are said to be contemplating the creation of a similar superintendency.

LOCOMOTIVE BUILDING.

The Bangor & Aroostook has recently purchased seven engines from the Manchester Locomotive Works, of Manchester, N. H.

The Schenectady Locomotive Works have about completed nine of the heaviest engines ever built at their works. The engines are of the 12-wheel type, having eight drivers coupled and a four-wheel leading truck. The cylinders are 22 in. dia., by 22 in. stroke. The drivers are 54 in. in dia. The boilers are designed for a working capacity of 180 lbs. per sq. in. The capacity of tank, 35,400 galls.; total weight of engine and tender, 236,000 lbs. They were designed by Mr. A. J. Pitkin, Superintendent of the works, and are to be used in the ore carrying trade of the Duluth & Iron Range.

CAR BUILDING.

The Lima Car & Manufacturing Co. is building 250 freight cars for the Noble Car Company, of Buffalo.

The Phillips & Rangeley Railroad will add 25 new platform and five new box cars to its rolling stock this spring.

The Michigan Central is building at its shops a handsome dining car from the designs of E. D. Bronner, Master Car Builder.

The Barney & Smith Car Company, of Dayton, O., is building two dining cars for the Lake Shore & Michigan Southern road.

The Delaware, Lackawanna & Western has ordered 500 coal cars of 30 tons capacity from the Jackson & Woodin Car Co., of Berwick, Pa.

The directors of the Huntingdon & Broad Top Mountain road this week decided to order 500 new coal cars for the use of the George's Creek & Cumberland Co.

The Kansas City, Pittsburgh & Gulf has recently ordered 100 box cars, and also a number of passenger cars. Part of the order for freight equipment has already been delivered.

The Canadian Pacific has built, at its Montreal shops, a train of cars, including sleeping cars, and dining, day and baggage cars and second-class sleeper, and also a locomotive weighing 62½ tons. The cars are exceedingly handsome, and the exterior finish is in mahogany. It is said that the train will be run through between Montreal and Chicago.

The order of the New York Central & Hudson River road for 1,200 freight cars was divided between the Michigan-Peninsular Car Company and the Buffalo Car Manufacturing Company. The order of the Buffalo Car Co. is for 500 box, 100 stock and 100 flat cars, and 500 box cars go to the Michigan-Peninsular Car Co. These cars are all to be equipped with the Fox pressed steel truck. This order is the largest given in this country for this truck.

BRIDGE BUILDING.

Baltimore, Md.—An ordinance appropriating $30,000 for a bridge at Edmondson avenue will be favored by the Council Committee on Bridges. The old Baltimore street bridge at Jones' Falls will form part of the Edmondson avenue structure. The committee will also report favorably on ordinance appropriating $25,000 for a bridge over Gwynn's Run, at Ramsay street.

Bellaire, W. Va.—The Baltimore & Ohio will put two new spans (steel plate girder) in the Ohio approach of its Bellaire Bridge over the Ohio River. A new foot bridge from its station across its yard tracks to the Bellaire, Zanesville & Cincinnati station will be erected.

British Columbia.—The residents on Lulu Island and in South Vancouver and on the north side of the North Arm of the Fraser are agitating for the erection of another bridge across the river at that point. The Provincial Government will be asked to aid the scheme.

Burmont, Pa.—The work of replacing the old wooden bridge on the Media branch of the Philadelphia, Wilmington & Baltimore, over Darby Creek, at Burmont station, with a double-track iron structure has been completed. The bridge at Wallingford, over Crum Creek, is now the only single track bridge between Philadelphia and Media, and that will soon be changed.

Catlettsburg, W. Va.—During the last hours of Congress a bill was passed authorizing the Chesapeake & Ohio Railroad to build a new bridge across the Big Sandy River from Catlettsburg, Ky., to Kenova, W. Va. The company's old bridge at this point was condemned several years ago. The new bridge will be located several hundred feet below the present bridge to do away with the heavy curve in the approach. The bridge will be constructed for both railroad and highway traffic, having two tracks. It will be 60 ft. wide, the railroad tracks in the centre, with a 10-ft. wagonway and a 5 ft. sidewalk on each side. Three spans will be 223½ ft. each, and the other two 153½ ft. each. The approach on the Kenova side will be over a 317-ft. viaduct. The bridge will be 35 ft. above high water.

Gadsden, Ala.—The citizens of Cherokee County will, at an early day, vote on the question of issuing $20,000 worth of bonds to assist in building a free bridge across Coosa River at that place. The bridge is to be built by a railroad, which proposes to connect with the Chattanooga Southern at or near Menlo, Ga.

Little Falls, Minn.—The city has decided to have the bridge across the Mississippi River at this point reconstructed, and work will be commenced at once.

Philadelphia.—An ordinance providing for the construction of the following bridges was passed last week by the Philadelphia Council: Girard avenue, over Pennsylvania avenue; on Seventeenth street, under the Connecting Railway; on Forty-ninth street, over the West Chester & Philadelphia Railroad; on Gillingham street, over Little Tacony Creek; on County Line road, over Poquessing Creek; on Wayne avenue, over and on Duval street, under the Germantown & Chestnut Hill branch of the Pennsylvania R. R.; on Frankford avenue, over Pennypack Creek; on Wyoming avenue, over Frankford Creek and race at Fisher's lane; on Kensington avenue, over the Richmond branch of the Philadelphia & Reading; on Thompson street, over the Richmond branch of the Philadelphia & Reading; on Woodbine avenue, under the Pennsylvania road; on Baltimore avenue, over Cobb's Creek; on Midvale avenue, over the Richmond branch of the Philadelphia & Reading; on Sixty-third street, over the Philadelphia, Wilmington & Baltimore road; for completing the Walnut street bridge over the Schuylkill River and the Oxford street bridge over the Connecting Railroad. The appropriation for this work is $214,800.

Pittsburgh, Pa.—The Tarentum Bridge Co., of Pittsburgh, was chartered March 7, with a capital of $2,000, and these directors: Chauncey G. Williams, George B. Dusinberre, Philip P. Barton, Arthur N. Davis, D. Bruce Kennedy, Pittsburgh. The company will erect a bridge over the Allegheny River, from New Kensington, Westmoreland County, to a point in East Deer Township, Allegheny County. The same incorporators have chartered the Creighton Bridge Co. to build a bridge over the Allegheny River from a point in Lower Burrel Township, Westmoreland County, to a point on the opposite side of the river in East Deer Township, Allegheny County.

St. Boniface, Man.—The Town Council of St. Boniface is reported to have decided to go ahead with the construction of a new bridge across the Red River between St. Boniface and Winnipeg. The city of Winnipeg has refused to pay any part of the cost of the bridge, and the town of St. Boniface will have to build it out of its own funds.

St. George, W. Va.—William M. Cayton and C. W. Minear, Commissioners of Tucker County, W. Va., will receive bids until April 4 for a highway bridge over Cheat River, at St. George. The two abutments and two piers will be of first-class masonry. The bridge will be 424 ft. in length; middle span, 200 ft. in the clear; two end spans, 112 ft. each; roadway, 14 ft. in the clear; height of truss for 200 ft. span, 32 ft.; for 112 ft. spans, 20 ft.; number of panels, 7 in each of the 112 ft. spans and 12 in 200 ft. span.

Spokane, Wash.—The County Commissioners have decided to advertise for bids for a trestle bridge at Silver Lake.

Proposals are wanted by the Board of Public Works until March 27 for the construction of a highway bridge across the Spokane River at the Olive avenue crossing.

Springfield, O.—Proposals are wanted until March 25 for the construction of a bridge over Lagonda Creek, on Lagonda avenue, by S. J. Wilkerson, City Clerk.

Tacoma, Wash.—The Tacoma Land Co. has completed a wagon bridge leading from Pacific avenue, Tacoma, across the tracks of the Northern Pacific to the water front. It is a combination Pratt truss bridge, 30 ft. in width, having one span 166 ft. in length and one span of 60 ft., with approaches 460 ft. long; cost $5,000; contractors, McDonald & Hodgins.

Whitehall, N. Y.—Governor Flower, of New York, has signed a bill appropriating $3,000 for a canal bridge at this town.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, Milwaukee & St. Paul, semi-annual, 3½ per cent. on the preferred stock, and 2 per cent. on the common stock, payable April 19.

Keokuk & Western, semi-annual, 1 per cent., payable April 1.

Lehigh Valley, quarterly, 1¼ per cent., payable April 15.

Manhattan, quarterly, 1½ per cent., payable April 1.

Oregon Railway & Navigation Co., quarterly, 1½ per cent., payable April 1.

Sunbury & Lewistown, semi-annual, 4 per cent, payable April 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Brookfield & Northern, annual, Brookfield, Mo., March 18.

Chicago & Alton, annual, Chicago, Ill.. April 3.

Cleveland, Canton & Southern, special, Canton, O., March 29.

Fort Worth & Rio Grande, annual, Fort Worth, Tex., April 4.

Joliet & Chicago, annual, Chicago, April 3.

Northern Pacific, special, New York City, April 20.

Pennsylvania, annual, Philadelphia, Pa., March 28.

Pittsburgh, Cincinnati, Chicago & St. Louis, annual, Pittsburg, Pa., April 11.

Tennessee Coal, Iron & Railroad Co., biennial, Tracy City, Tenn., April 4.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The American Association of General Passenger and Ticket Agents will hold its annual meeting at Cumberland Gap Park, Tennessee, March 21.

The *New England Railroad Club* meets at the United States Hotel, Boston, Mass., on the second Wednesday of each alternate month, commencing January.

The *Western Railway Club* meets at the rooms of the Central Traffic Association in the Rookery Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 7:30 p. m.

The *Central Railway Club* will meet at the Hotel Iroquois, Buffalo, N.Y., on the fourth Wednesday of March.

The *Northwest Railroad Club* meets at the St. Paul Union Station, on the first Saturday of each month, except during June, July and August, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7:30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p. m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Denver Society of Civil Engineers meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7:30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal.; on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Civil Engineers' Association of Kansas* meets at Wichita, Kan., on the second Wednesday of each month, at 7:30 p. m.

The *American Society of Swedish Engineers* meets at the clubhouse, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

Arbitration Committee, M. C. B. Association.

At the last meeting, held in Chicago on Feb. 16 and 17, 1893, decisions were given in Cases 154 to 173.

The members present were as follows: F. D. Casanave, Chairman; M. M. Martin, John Mackenzie, G. W. Rhodes and J. N. Marden.

The Arbitration Committee requests that all suggestions of desirable modifications in the Rules of Interchange should be communicated to the Secretary before May 10, 1893, so that the Arbitration Committee may consider them at its next meeting, which will be held soon after that date.

Engineers' Club of Cincinnati.

At the monthly meeting of the Club in the rooms of the Literary Club, 24 West Fourth street, Cincinnati, on Thursday, March 16, a paper on "Sidewalk Improvements in the Vicinity of Cincinnati" was read by Mr. E. F. Layman.

At the February meeting of the Club one new member was elected and five applications for membership were received. There were 26 members present.

Papers on the following subjects were read:

1. Suggestions on the treatment of the Miami Canal, by Major L. M. Hosea, who treated the subject from an artistic point of view, pointing out how the canal and the land on either side could be improved and beautified by borders of grass and foliage, walks and roadways, and the canal itself used for pleasure boating as well as for transportation. The use of the water for street sprinkling, fire purposes, sewer flushing, etc., including, of course, the purification of the water and keeping it free from contamination, were also suggested.

2. Peculiarities of Numbers, by Oswald Dietz, which was an explanation of the law or rule governing the fact that the square of any number cannot have as its last figure 2, 3, 7 or 8, and that the bi-square of every number which is not a multiple of 5 can have as its last figure only 1 or 6.

3. A Proposed Plan for Disposal of Overhead Wires in Cities, by Col. Latham Anderson. The plan proposed was that of placing the wires directly over the sidewalks at a height of 18 ft. on suitable supports extending from poles on the curb line, about 80 ft. apart, to the buildings, and preventing the falling of the wires to the sidewalk in case of breakage, by a mesh of wires with ground connection through the poles. Another plan would be the placing of the wires directly under the sidewalks in area ways between the curb and the house line. Sewer, water and gas pipes could also be so placed.

Engineers' Club of Philadelphia.

A regular meeting of the Club will be held on Saturday, March 18, at 8 o'clock p. m. Mr. George S. Webster will exhibit, by means of the lantern, photographs of Philadelphia bridges, and give descriptions of their important features.

A business meeting was held March 4, President John Birkinbine in the chair, 50 members and visitors present. The tellers reported the following elections to active membership: Messrs. S. T. Wellman, H. O. Duerr, George M. Sinclair, B. C. Batcheller, Francis L. Miller, F. B. Brown, Wm. Penn Evans, Chas. E. Wolle. Mr. J. T. Stiles and Dr. S. L. West were elected to associate membership.

Professor Joseph T. Rothrock made the address of the evening on "Wood Structure in Its Relation to Mechanical Purposes," with the aid of photographs and sections of wood, projected by the lantern. He explained the effect of cellular and woody fibre upon the strength and durability of the wood, pointing out the predominance of one or the other kinds of growth in different trees, and their consequent adaptability to different purposes. He explained that while the so-called annual rings might be used in counting the life of a tree, in most cases this was not an invariable rule, and one might be misled in following it in some cases.

He closed by showing the distribution of the timber area in the State of Pennsylvania, and called attention to the necessity for better supervision for its protection. His remarks were discussed at considerable length by Messrs. Birkinbine, Prince, Falkenau, Wilfred Lewis and others.

Freight Claim Agents' Association.

This association met in St. Louis March 8, 9 and 10, about 70 members being present. Following are the officers for the ensuing year: *President*, Fred Farrington, Northern Pacific, St. Paul; *First Vice-President*, John T. Denniston, Union Line, Pittsburgh, Pa.; *Second Vice-President*, G. C. Arnold, St. Louis Southwestern, St. Louis, Mo.; *Secretary and Treasurer*, S. A. Meherter, Pennsylvania, Philadelphia. C. S. Sutton of the Atchison, Topeka & Santa Fe was re-elected a member of the Arbitration Committee. Reports were made by the committees on Constitution and By-Laws, on Overcharges and Rules, and on Losses and Damages. The next meeting will be held in Detroit on Aug. 9.

Master Car Builders' Association.

The Committee on Steel-Tired Wheels have issued the following circular to the members of the M. C. B. Association:

1. What type of centres for steel-tired car wheel do you prefer?

2. In what respect do you regard this type superior to others?

3. Do you regard spoke centres objectionable for use under passenger cars, and, if so, for what reasons?

It is desired only to have a preference expressed for one of the types of centres—solid cast, cast spoke, wrought disc, wrought spoke or wrought or steel plates, bolted to hub and tire—and not for any particular make.

These queries, it will be noted, refer only to the centres, and the tires should not be given consideration in making replies, except in so far as they may be affected by the type of centre.

Replies should be sent direct to the chairman of the committee, Mr. R. E. Marshall, Superintendent Motive Power, Philadelphia, Wilmington & Baltimore Railroad, Broad Street Station, Philadelphia.

National Association of Freight Clerks.

This Association met in Cleveland last week. Its functions are chiefly of a social nature and the President is L. M. Chesborough, of Chicago. The meeting was held in connection with the semi-annual meeting of the Central Traffic Association roads for the preparation of rate sheets.

New England Railroad Club.

The eleventh annual meeting was held Wednesday evening, March 8, 1893. President Twombly occupied the chair, and called attention to the resolution to so change Section 1, Article 1, of the By-Laws of the Association as to provide that the regular meetings of the Club shall be held monthly instead of bi-monthly as heretofore. The resolution was adopted.

The report of the Nominating Committee appointed at the last meeting was presented and accepted, and the following officers were elected for the ensuing year: *President*, John T. Chamberlain; *Vice-President*, L. M. Butler; *Secretary and Treasurer*, Francis M. Curtis; *Executive Committee*, the President, F. D. Adams, James N. Lauder, G. W. Marden, F. M. Twombly, L. M. Butler, George Richards, John Medway and Orlando Stewart; Finance Committee, George B. Swett, John Kent, A. G. Barber, Henry L. Leach, Daniel S. Page, Isaac N. Keith. Charles Richardson, George H. Wightman.

Thirteen new members were added to the roll of the Club at this meeting.

President Chamberlain announced as the subject for discussion at the April meeting, "The Past Winter's Experience in the Continuous Heating of Passenger Trains." The discussion at this meeting appears on another page.

New York Railroad Club.

At the meeting of the Club on the evening of the 16th, at 12 West Thirty-first street, Mr. W. F. Dixon (Chief Draftsman Rogers Locomotive Works) read a paper on "Locomotive Boilers."

Western Railway Club.

The regular monthly meeting of the Western Railway Club will be held on Tuesday, March 21, at 2 o'clock p. m., in room 850 Rookery Building, Chicago. The paper on tests of compound locomotives, read at the last meeting by Mr. William Forsyth, will be discussed. The subject of the revision of the Rules of Interchange will also come up at this meeting.

PERSONAL.

—Mr. J. S. McCullough, Assistant General Passenger Agent of the Chicago, St. Paul, Minneapolis & Omaha, has resigned, to take effect March 15.

—Sir George Findlay, the General Manager of the London & Northwestern (Eng.), is seriously ill, having been absent from his duties nearly a month. He underwent a successful operation on the 21st ult.

—Judge Daniel Rhodes, of Bellefonte, Pa., who died there March 11, aged 71, was one of the projectors of the Bellefonte & Snowshoe Railroad, and on its completion in 1860 was elected Superintendent and General Manager, which place he filled until the road was absorbed by the Pennsylvania in 1882.

—Mr. E. P. Lord, who has been Superintendent of Motive Power on the Cleveland, Cincinnati, Chic ago & St. Louis for the past year, going to that road from the Pennsylvania, has resigned and it is reported will be succeeded as Superintendent of Motive Power by Mr. William Garstang, who now holds a similar position on the Chesapeake & Ohio.

—Mr. James W. Hyatt, ex-Treasurer of the United States, died at Norwalk, Conn., March 12. Mr. Hyatt secured control of the street railroad at Norwalk in 1873, and shortly after that time he was elected Vice-President of the Danbury & Norwalk Railroad Co., which position he held until 1881, when he became President. Under his direction the road was extended to Wilson Point, thus securing the tide-water terminal on Long Island Sound.

—Mr. Thomas C. Platt resigned the Presidency of the Tennessee Coal, Iron & Railroad Company this week, a position which he has held for about a year, his resignation to take effect at the annual meeting on April 4. There is little doubt that his successor will be Mr. H. F. De Bardeleben, of Birmingham, Ala., President of the De Bardeleben Coal & Iron Company, which was consolidated with the Tennessee Coal & Iron Company a year ago, and now holds a controlling interest in the consolidated company.

—Mr. M. B. Cutter has succeeded Mr. E. Holbrook as Superintendent of the Pittsburgh Division of the Baltimore & Ohio. He is now about 32 years old, and has been in railroad service since he was 17 years of age. He was formerly on the Northern Pacific, and was also Division Superintendent of the Chesapeake & Ohio, but for the last two or three years he has been General Superintendent of the Newport News & Mississippi Valley road. He also held a similar office on the Louisville, New Orleans & Texas before its lease to the Illinois Central.

—Mr. James McArthur, of the firm of McArthur Brothers, railroad contractors, of Chicago, died at his residence in the latter city on March 11, aged 61 years. Mr. McArthur was a civil engineer by profession, and his first important work was in 1867, when he had charge of the improvement of the Kanawha River, as engineer, at Parkersburg, W. Va. Two years later he became interested in the organization of the Cleveland & Marietta Railroad, and he was heavily interested in the construction of that line. In 1876 he removed to Chicago and became a member of the contracting firm of McArthur Brothers, which has had some of the largest contracts on new railroads in the West.

—Mr. John Morton Byers, aged 61, died at Swissvale, Pa., March 4. At the time of his death he was Engineer on the Pennsylvania's Western Division. Prior to that he had been Assistant Superintendent of the Lehigh & Susquehanna, Resident Engineer of the Philadelphia & Erie, Chief Engineer of the Mifflin & Centre County Railroad, and Chief Engineer of the Pittsburgh, Virginia & Charleston. Mr. Byers belonged to a family of engineers. His father, Joseph Byers, was for years a Civil Engineer on the Pennsylvania. Of his six sons, five were engineers, one of whom, Charles Byers, was Chief Engineer of the Philadelphia & Reading until his death, and another son, Joseph, was Chief Engineer of coast defences, United States of Colombia, S. A. John M., just deceased, was his eldest son.

—Mr. A. W. Stedman, who has been Chief Engineer of the Lehigh Valley road since 1883, has resigned that position, but will remain in the service of the company as Consulting Engineer. On March 4 of this year Mr. Stedman had been in the service of the Lehigh Valley Company for 32 years. He was born in Mauch Chunk, and when 17 years old became a telegraph operator on the road. He served two years in this position and was then levelman for three years and Assistant Engineer of the company for 15 years. In 1881 he became Principal Assistant Engineer, and then Chief Engineer two years later. Since the lease to the Philadelphia & Reading his title has been Chief Engineer of the Eastern and Northern divisions of that system, which include the Lehigh Valley lines. Mr. Charles E. Webster, who has been Assistant Engineer, will have charge of the Engineering Department for the present. He has also been connected with the Lehigh Valley for some time. He was Chief Engineer of the Schuylkill & Lehigh Valley road during its construction, and has been Assistant Chief Engineer of the Lehigh Valley since its completion.

ELECTIONS AND APPOINTMENTS.

Alabama Great Southern.—A. J. Frazier, Trainmaster of the Eastern Division of the Ohio & Mississippi, has been appointed Superintendent of the division extending from Chattanooga to Meridian, succeeding J. McCarty, with office at Birmingham, Ala.

Atlanta & Charlotte Air Line.—At the annual meeting held in New York the following directors were elected: Eugene Kelly, P. P. Dickinson, Richard Irvin, R. H. Rochester, Charles S. Fairchild, B. R. McAlpine and Ebenezer S. Mason of New York; H. W. Sibley, of Rochester, N. Y.; Joseph Bryan, of Richmond, Va.; Skipwith Wilmer and Michael Jenkins, of Baltimore, Md., and D. J. Garth, of Scarsdale, N. J. The following officers were elected: Eugene Kelly, President; W. N. Wilmer, Secretary, and George Sherman, Treasurer.

Atlantic & Western.—T. L. Clarke has been appointed Acting Superintendent of this company, with office at Orange City, Fla.

Baltimore & Ohio.—M. B. Cutter has been appointed Superintendent of the Pittsburgh division, with headquarters at Pittsburgh, to fill the vacancy occasioned by the resignation of E. Holbrook.

Chicago Great Western.—John L. Pratt has been appointed General Claim Agent, vice M. C. Woodruff, who has been appointed Land and Tax Commissioner, with office at St. Paul, Minn.

Chicago, Rock Island & Pacific.—C. H. Hubbell has been appointed Superintendent of Terminals of the Chicago District, including Chicago, South Chicago, West Pullman and Burr Oak, with office at Van Buren Street Depot, Chicago. The Superintendent of Illinois Division is relieved from jurisdiction east of Blue Island, as above.

R. B. Agnew, Assistant Superintendent of the Eastern Division, succeeds Mr. Hubbell as Superintendent of the Western Division, with headquarters at Colorado Springs, Col.

Clayton & Pea Ridge.—The following are the officers of this new Illinois company: G. W. Montgomery, President; T. J. Clark, Vice-President and Treasurer; Capt. D. M. Holsted, General Superintendent, and C. A. Wever, Secretary, all of Clayton, Ill.

Cleveland, Akron & Columbus.—W. K. Richards, formerly General Freight and Passenger Agent of the Cleveland & Marietta, has been appointed to a like position on the above road, to succeed H. B. Dunham, resigned.

Cleveland, Lorain & Wheeling.—This week L. R. Perkins, President; Oscar Townsend, General Manager; A. S. Gorham and C. L. Cutter tendered their resignations as directors, and W. D. Woodford and W. R. Woodford, of Cincinnati; J. B. Dennis, of New York, and L. A. Russell and J. E. Terry, of Cleveland, were chosen in their places. The only directors holding over are John Newell, President of the Lake Shore Railroad, and E. B. Thomas, of New York, Vice-President of the Erie. After this election the new board met and elected W. D. Woodford, President; J. B. Dennis, Vice-President; and W. R. Woodford, General Manager.

Elgin, Petitcodiac & Havelock.—J. Gillis Jones has resigned his position as Manager. He will be succeeded by J. D. Chipman, of St. Stephen, N. B. A. H. Robinson has been appointed to the position of Superintendent, with office at Petitcodiac, N. B.

Elmira, Cortland & Northern.—At the annual meeting held in New York, March 14, the following directors were re-elected: Austin Corbin, George S. Edgell, William G. Wheeler, E. R. Reynolds, J. Rogers Maxwell, H. W. Maxwell, Frank M. Kelley, F. W. Dunton, J. K. O. Sherwood, all of New York; A. A. McLeod and J. D. Campbell, of Philadelphia; F. C. Cromwell and Frank J. Enz, of Ithaca, N. Y.

Fort Worth & Denver City.—The annual meeting was held at Fort Worth, Tex., last week, and resulted in the re-election of the old directors and officers. The officers are: Morgan Jones, President; G. M. Dodge, Vice-President; S. H. H. Clark, Second Vice-President; W. A. Ross, Secretary, and J. G. Jones, Treasurer.

Mexican Central.—H. A. Young has been appointed Car Accountant, with headquarters in city of Mexico. Mr. Young has been Chief Clerk to the Assistant Manager for the past three years.

Missouri Pacific.—At the annual meeting of the stockholders at St. Louis, March 14, the following board of directors was elected: George J. Gould, Russell Sage, A. L. Hopkins, Edwin Gould, Louis Fitzgerald, John P. Munn, John G. Moore, Howard Gould, Samuel Sloan, Thomas T. Eckert and D. D. Parmley, of New York; Carlos S. Greely and S. H. H. Clark. The new directors are Howard Gould and Louis Fitzgerald.

New York Central & Hudson River.—Trainmaster C. A. Beach, of Syracuse, N. Y., has been assigned to the duties performed by Assistant Superintendent Henry Goold, of Rochester, during the absence of Superintendent Burrows on leave of absence.

New York, Lake Erie & Western.—J. Haines, formerly Master Mechanic of the Western Division at Salamanca, N. Y., has been appointed Master Mechanic of the Delaware Division to succeed H. A. Gillis, with office at Port Jervis, N. Y.

New York & New England.—The annual meeting was held in Boston, March 14, and resulted in the election of the following directors: Archibald A. McLeod, Joseph F. Sinnott, Samuel Heilner, Charlemagne Tower, Jr., George H. Earle, Jr., and Spencer Ervin, Philadelphia; Arthur Sewall, Bath, Me.; Joseph Hensler, Jr., Jersey City; Charles E. Gross, Hartford, Conn.; F. H. Prince, Charles A. Prince, Boston; B. F. Vaughan, Providence, R. I.; Arthur Brock, Lebanon, Pa.; D. S. Plume, Waterbury, Conn.; H. G. Dupont, Wilmington, Del.; C. W. Chapin, Thomas C. Platt, James Armstrong, New York, and James W. Deane, Chicago. Messrs. McLeod, Platt, and F. H. Prince received each 154,647 votes, about 3,000 fewer votes than were received by the other directors elected. The directors elected A. A. McLeod, President, F. H. Prince, First Vice-President, and George F. Randolph, General Traffic Manager.

New York, Susquehanna & Western.—The annual meeting was held at Jersey City, March 9. The following directors were re-elected: Simon Borg, Joseph W. Ogden, James M. Hartshorne, Frank C. Lawrence, Jr., Alfred Sully, Charles Minzesheimer, Henry Sanford, John I. Blair, Robert K. Dow, Garret A. Hobart, and Horace W. Fuller. H. O. Armour and Roswell Eldridge were elected in the places of J. P. Rafferty and G. M. Farwell. The Board elected these officers: President, Simon Borg; Vice-Presidents, Joseph W. Ogden and Joseph R. Rafferty.

Ohio & Mississippi—N. J. Neer, who has been Passenger Agent of the company at Springfield, Ill., for a number of years, is now Division Passenger Agent for central and northern Illinois.

Oregon Pacific.—E. W. Hadley, Receiver, announces the appointment of R. E. Mulcahy, formerly Superintendent, as General Superintendent in charge of the rail, river and ocean divisions of the above named company, with headquarters at Corvallis, Or.

H. C. Day is appointed General Agent of the Oregon Pacific and Willamette Valley & Coast railroad companies, headquarters at Portland, Or., and D. R. Vaughn is appointed General Agent headquarters at San Francisco, Cal. C. Sullivan is appointed Superintendent of tracks, bridges and buildings, headquarters at Corvallis, Or.

Pecos Valley.—S. S. Satchwell, General Freight and Passenger Agent, has resigned, and the duties of the office will be assumed by General Superintendent J. N. Miller, assisted by Chief Clerk A. T. Canfield.

Pontiac, Oxford & Northern.—W. C. Sanford has been appointed General Freight and Passenger Agent of this company, with office at Pontiac, Mich. He was formerly Assistant General Passenger Agent.

Silver Springs, Ocala & Gulf.—Notice has been given of the appointment of the following officers, with headquarters at Ocala, Fla.: O. G. Finch, Assistant Superintendent, and P. V. Lang, Acting Auditor.

Terminal Railroad Association.—The annual meeting was held at St. Louis, March 8. The following directors were elected: William Taussig, Frank W. Tracy, E. P. Bryan, M. E. Ingalls, Charles M. Hays, George C. Smith and James W. Way.

West Virginia & Pennsylvania.—The company elected the following Board of Directors at a meeting held at Fairmont, W. Va., last week: R. T. Lowndes, Benjamin Wilson, A. O. Tinsman, A. G. Smith, C. S. O. Tinsman, T. W. Fleming, W. S. Haymaker and S. W. Taylor. R. T. Lowndes was elected President.

Wheeling Bridge & Terminal Railway Co.—On Tuesday, March 13, the stockholders elected as directors C. O. Brewster, W. A. Wilson, N. E. Whitaker, W. B. Thomas, R. H. Stearns, A. H. Olmstead, J. K. Tod, R. H. Rochester and R. B. Berris.

RAILROAD CONSTRUCTION.

Albuquerque & Durango.—The local newspapers report that the projectors of this road have arranged for the building of the first 50 miles of the proposed line south of Durango, Col., by an English syndicate organized by H. W. Fowler, of Chicago.

Aspen & Maroon.—The preliminary surveys and estimates on this new road in Colorado have been completed by the Chief Engineer, C. E. Shriver, of Aspen, Col. The charter of the company is for a line from Aspen to the head of Maroon Creek, a distance of 15 miles, and the line is intended chiefly for the development of the mines in that district. The officers have not yet decided when to begin the construction. The work will be light, the maximum grades being four per cent. and the maximum curves 12 deg. J. E. Freeman is President and W. S. Clark, Treasurer, both of Aspen Col.

Baltimore & Ohio.—The company is preparing to resume active work on the completion of its State Line Railroad between Morgantown, W. Va., and Fair chance, Pa. Contractors are engaging laborers and sending them to the line of the road, which, when completed, will connect the Baltimore & Ohio's Pittsburgh Division with the main line west via Uniontown, Morgantown and Fairmont. The new line will probably be opened for business in September. North of Morgantown the road reaches a fine vein of coking coal.

Beaver Creek.—This company, which, as mentioned a few weeks ago, has engineers surveying a route for an extension eastward from the terminus at the headwaters of Stony River, in West Virginia, last week gave a mortgage for $500,000 on a large body of coal land it owns in Grant County, W. Va., and it is stated that the money will be used for the purpose of constructing the extension. The company now has a line

14 miles in length, starting from the West Virginia Central & Pittsburg road at Davis, Tucker County, W. Va., and extending up the Beaver Creek Valley to Stony River. The engineers have completed the new survey as far as Moorefield, Hardy County. From there it has not been decided what direction will be taken. Three routes are under consideration: One to a connection with the Baltimore & Ohio at Romney, to a connection with the Cumberland Valley at Winchester and to Straasburg.

Boston & Maine.—Work of preparation for the double track of the Gloucester branch of the road is going forward rapidly in spite of the bad weather. It is intended to complete the work by June 1.

Burlington & Southwestern.—Surveys are now being made by this company, recently chartered in North Carolina, for a line from Burlington, N. C, on the Richmond & Danville, southwest to a connection with the Cape Fear & Yadkin Valley road near Liberty Station, the distance being 25 miles. W. S. Holt, of Burlington, is President of the road.

Burrard Inlet & Fraser River Valley.—The Divisional Court of the Province of British Columbia has declared invalid the by-law granting $300,000 to this company, which is to connect Vancouver, B. C., with the Northern Pacific at Sumas, Wash. Percy Dickinson, of Tacoma, who has the contract to build the road, explains that this decision is on a technical point and was expected, but he hopes that the subsidy will still be secured by the new company.

Cambria Lumber Co.—The road being built up Shade Creek, from Foustwell, Pa., by the above company, is a narrow gauge road, and connects with the Somerset & Johnstown branch of the Baltimore & Ohio at Foustwell, 11 miles south of Johnstown. About 4½ miles is now graded and rails are being laid. This road, when finshed will be about 10 miles in length and is intended for the purpose of hauling bark and logs, but may eventually develop into a road for general traffic. John W. Morris, of Seanor, Pa., is Manager.

Chicago, Indiana & Eastern.—Articles of incorporation of this company were filed in Illinois last week. More than half of the shares of stock issued are held by Henry A. Thayer and Lester J. Barr. The only description of the route given in the charter is that it is proposed to build a road from Chicago to Columbus, passing through Union City, Ind. The directors are: Henry A. Thayer, Lester J. Barr, W. W. Paddock, F. A. Roof, James C. Henvis, W. M. Nichols, John W. Twiggs, C. W. Kilgore, and O. W. Lamport.

Chicago, Joliet & Western.—The road projected by this company, chartered in Illinois last week, is given in the charter as beginning at a point near Chicago and extending southwesterly across the state to a point on the Mississippi River, in Rock Island County. The incorporators, who are also the first Board of Directors, are: J. W. Taylor, L. M. Martin, Newton P. R. Hatch, John Davis and David Williams, all of Chicago.

Chicago, Rock Island & Pacific.—The contracts for the grading for about 50 miles south of the present terminus of the road to Bowie, Tex., have been let recently, and the work is now in progress. The work is medium and there are no important bridges or other structures on the present contract. It is still uncertain what town will be the southern terminus of this extension. Surveys have been made both to Fort Worth and Dallas, which are between 70 and 80 miles south of Bowie, and the charter of the Texas corporation has been recently amended so that lines can be built to both towns.

Clearfield & Mahoning.—The track laid on this road since Jan 1, 1893, amounts to 13 miles, and the engineers are now waiting to put up several important bridges before the balance of the work can be finished. They expect to have the track all laid between Clearfield and Jefferson Line, Pa., by May 1, the distance being 26 miles. J. M. Floesch, of Clearfield, Pa., is Chief Engineer.

Concord & Montreal.—The bill authorizing the Concord & Portsmouth railroad to relay the rails between Candia and Suncook, N. H., was passed without opposition by the New Hampshire House last week. The distance between these towns is 18 miles, and the line is partly graded. When the company began to relay the tracks early in 1890 it was enjoined by the Boston & Maine, and the litigation has been continued to the present time.

Corpus Christi & Eagle Pass.—The local papers report that nearly all of the required bonus for the construction of the road has been subscribed. The proposition was made by New York parties to furnish funds to build the road, provided the citizens along its route would raise a bonus. G. W. Westervelt, of Corpus Christi, Tex., is one of the projectors.

Crystal River.—Grading on the 17 miles of the standard gauge line is one-half done and entirely completed on the 13 miles of narrow gauge. This is built by the Colorado Fuel & Iron Co., without bonds, to open up fields of coking coal near Carbondale, Col., and on Crystal River. Coke ovens will be built at the junction of the standard and narrow gauge tracks. One Baldwin standard gauge and one narrow gauge locomotive have been ordered.

Denver & Noland.—Incorporated March 6 by George B. McFadden, A. A. Mathews, A. L. Parish, John Reichard and L. W. Hoyt. The road is surveyed from Denver through Longmont to the Noland coal field. The capital is $100,000.

Denver & Rio Grande.—Progress on the Crested Butte branch extension to new anthracite fields above Aspen, Col., is slow owing to heavy snow. All trouble with the Union Pacific has been settled and no joint track agreement for a portion of the way will be necessary.

Dunnellon Phosphate.—The Dunnellon Phosphate, Railroad & Transportation Co. has been incorporated by John L. Inglis and Ralph Baker, of Madison, Fla.; H. D. and John W. Auchincloss and C. K. Dutton, of New Nork City; W. L. Bradley, Boston; J. M. Schumacher and J. R. Tysen, of Jacksonville It intends building a railroad from Dunnellon to the Early Bird phosphate mines, then north to Amelia Island, on the Atlantic, and south from Dunnellon to deep water on Tampa Bay. The capital stock is $100,000.

Everett & Monte Cristo.—Regular trains will probably begin running over the western section of the road between Snohomish and Everett, Wash., about 15 miles, this month. The opening of the road between these points is delayed now only by ballasting and this work is advancing rapidly.

Gainesville, McAlester & St. Louis.—The company has been granted a charter for a road through the Indian territory, to be built from South McAlester to Gainesville, Tex., through Lehigh and Coalgate, I. T. The distance between Gainesville and Coalgate, the first section, is 72 miles. The road will probably be extended north from South McAlester to Fort Gibson, making through connections with the Missouri Pacific system.

Great Salt Lake & Hot Springs.—General Manager Simon Bamberger says that as soon as the weather settles he will begin operations on the Coalville extension. He will at once start work at the present northern terminal of the line north six miles to Farmington, Utah. The surveyors have about completed the preliminary survey between Farmington and Coalville.

Indian Creek Coal, Transportation & Railroad Co.—This company was chartered in West Virginia last week for the purpose of building a road, 15 miles in length, up from the mouth of Indian Creek, which empties into Elk River, in Kanawha County, W. Va. The incorporators are Charles J. Hunt, Walker L. Granger, W. A. Sorin and James G. Hunt, of Cincinnati O., and P. J. Zumy, of Hartwell, O. The road will be a feeder of the new Charleston, Clendennin & Sutton road, which it joins at the mouth of Indion Creek. This latter road is completed as far as Clendennin, W. Va., 17 miles, except that a part of it has not been ballasted on account of the severe weather.

Middlesex Valley.—A bonus of about $10,000 has been raised for the extension of this line to Geneva, N. Y., and the right of way has been given for most of the distance; and it is stated that the company has agreed to build the extension this summer. The line will be about 20 miles long beginning at Stanley and extending along the western shore of Lake Canandaigua for part of the distance to Geneva on the Lehigh Valley road.

Nashville, Morristown & Atlantic.—C. E. Buel, of Ohio, Manager of this road, has offered to build the Unaka & Nola Chucky road from Morristown to Embreeville, Tenn., 60 miles, if that company can secure stock to the amount of $2,000 a mile and the right of way. J. L. Cain, of Morristown, Vice-President of the Unaka & Nola Chucky, states that 80 per cent. of the right of way is secured, and that only $65,000 of the stock subscriptions asked for are unsubscribed. He has submitted a proposition to the citizens of Morristown to raise $50,000 of this. A surveying party is now engaged on the survey.

Nevada Southern.—Trains are now running to Blackburn, 13 miles west of Goffs, Cal., and grading has been completed to Summit, 30 miles. It is expected that the road will be in operation to the New York mining district, in Nevada, by April 1. The ultimate destination to be reached is the Goodspring district, in Nevada. One Brooks locomotive has been ordered and a second one will be purchased. Daily trains will be run. R. S. Seibert, of Denver, is General Manager.

New Roads.—P. C. Thomas, of Thomasville, N. C., has just obtained a charter through the North Carolina Legislature for a road to be built within a year. The route is not given.

A light steam railroad is proposed between Moreland and Luthersville, Meriwether County, Ga., at a cost of $20,000, and $11,000 of the amount to build the road has been subscribed.

Norfolk & Western.—This company is building a four-mile extension up the right fork of Twelve Pole River in West Virginia to open coal land which is being developed by private parties.

North Bend & Kettle Creek.—The route of this road, as stated in the charter recently filed at Harrisburg, Pa., is from the Philadelphia & Erie road near North Bend, Pa., to Stone House on Kettle Creek, Potter County, Pa., 15 miles. About 5½ miles of this has been built three years, and operated in connection with some branches not included in the charter, as a private property for a lumber road. The owners expect to build about 6 miles north toward Kettle Creek the coming summer, but they cannot do any work at present on account of deep snow. The route is north from North Bend up Young Woman's Creek, and thence down a branch of Kettle Creek to destination. The road will be operated principally to carry lumber and bark, but the opening up of this large amount of new country will create considerable other freight business, as well as passenger travel. F. A. Blackwell, of Driftwood, Pa., President of the road, states that the survey is about completed, and that the building of the road will be pushed as fast as possible as soon as weather will permit. A. H. Shafer, of Sinnemahoning, Pa., is the engineer in charge.

North Carolina Roads.—The following railroads were chartered by the State Legislature: Winston-Salem & Charleston, Carthage & Western, Atlantic & Ohio, Blowing Rock & Lenoir, New River & Swansboro, Durham & Charlotte, Columbia, Charlotte & Winston, Charlotte, Troy & Sanford, Rutherford & Polk County, Cheraw & Darlington, Cheraw & Aulander, Cape Fear & Raleigh, Catawba Fall Bridge Railroad, Elizabeth & Pasquotank, Madison, Reidsville & Haw River Valley, Yadkin Railroad Co., Virginia & North Carolina, and the Lumber River Railroad company.

Northeastern Elevated.—Work on the elevated road in Philadelphia progressed rapidly during the recent few days of fine weather. The contract for the iron work will probably be awarded in a few days. It is understood that the Pencoyd Iron Works will supply the first iron work for the road. Work on the Market street line will be recommenced at Forty-fourth street and Elm avenue this week.

Ohio River & St. Louis.—The charter of this road, recently filed in Illinois, provides for a road from a point on the Ohio River, at Golconda, Ill., westerly through Pope and Johnson counties to a point on the Paducah division of the Cairo Short Line, near the station of Reesville. The principal office is in Golconda and the capital stock is $150,000. The incorporators are: James A. Rose, William P. Sloan, Thomas McGown, Harrington Clannohan, Penn V. Trevillion and John Gilbert, Jr., of Golconda; James R. Steagall, of Brownfield, and James A. Whiteside, of Allen Springs.

Ottawa & Parry Sound.—The first 25 miles of this road west of Ottawa to Arnprior, Que., connecting at that point with the Canadian Pacific, is reported to be ready for operation and regular trains will soon be put on this section by the Canada Atlantic road, which controls the new line. The latter company is now operating the Parry Sound Colonization Railroad between Emsdale, Ont., and Bear Lake, 18 miles, which is to form part of the new line between Ottawa and Parry Sound on Georgian Bay.

The company has commenced the construction of the bridge across the Madawaska River at Arnprior. The cost, it is said, will be about $100,000.

Portland, Monterey & Gulf.—J. H. Barrett, of Houston, Tex., who has had large contracts on Texas railroads and recently built the North Galveston, Houston & Kansas City road, states that he has taken the contract to build this line and is now shipping his outfit to Portland, Tex., on the San Antonio & Aransas Pass road. This town is on Corpus Christi Bay, and it is to be the northern terminus of the proposed road. The line is projected from Portland to Brownsville and south through Mexico. The locating survey is reported to have been run as far as Sharpsburg, about 30 miles south, of Portland. John Willacy, of Portland, has a sub-contract in Refugio County.

Potomac Short Line.—This company was chartered last week in West Virginia to build a short line from Berkeley Springs, Morgan County, W. Va., to some undeveloped coal and timber land in the same county. The incorporators are T. H. B. Dawason and five others of Berkeley Springs. The capital stock paid in is $20,000. The road will be five miles in length.

Rice Lake, Dallas & Menominee.—A preliminary survey is now being made by H. E. Clark, of St. Paul, Chief Engineer, from Rice Lake, Wis., north through Dallas to the town of Menominee, a distance of 45 miles. This company was recently organized by L. C. Olmstead, of St. Paul, President, and J. E. Horsman, of Rice Lake, Secretary and Treasurer.

Ronceverte & Lewisburg.—This company was chartered in West Virginia last week to build a line from the Chesapeake & Ohio at Ronceverte, Greenbrier County, W. Va., to Lewisburg, in the same county. The capital stock is $100,000, held by Charles D. Haines and T. F. Woodworth of Kinderhook, N. Y.; James Purcell, of Valatie, N. Y., and E. S. Bell and W. L. Moore, of Lewisburg, W. Va. The road will be about seven miles in length. The town of Lewisburg has voted a subscription of $15,000 to the capital stock. Mr. Haines, who is president of the company, has agreed to have the road completed by July 4, next.

St. Louis, Keokuk & Northwestern.—During the past week work on the new branch, which leaves the present line near Old Monroe, Mo., and makes a direct route into St. Louis, has been finished, the track laid and most of the road ballasted. Heretofore the Burlington trains have entered St. Louis from St. Peters over the Wabash, but that contract expires soon, and the effort is being made to get the new Missouri River bridge done and everything ready for trains as soon as possible. The bridge will cross the Missouri River about 18 miles below Old Monroe, and the construction of that is being pushed.

Texarkana & Fort Smith.—The construction of the extension south from Texarkana, Tex., the objective point being Sabine Pass, continues to excite lively local interest. Recently the citizens of Shreveport, La., made an offer of $200,000 as a bonus to the road if it would build to that city, but this offer has been declined by President Whitaker, who has submitted to the Shreveport people a proposition which they now have under consideration. Last week a committee from Marshall, Tex., who asked that the line be extended through that town were informed that the management of the road had not definitely decided as to the exact route its line would take.

Texas & Gulf.—W. M. Robertson, E. J. Fry, of Marshall, Tex., and other of the projectors have asked a subsidy from the town of Marshall and from Harrison County, Tex., and at a town meeting this week the propositions of the projectors were agreed to and committees appointed to secure the necessary amount. The projectors state that an eastern syndicate has agreed to build the first 60 miles of the road south from Marshall and to begin work promdtly if the subsidy is secured without great delay.

Texas Trunk.—The residents living along the line are urging the extension of this road from its present terminus at Cedar south via Athens to Palestine, Tex. This road is built from Dallas to Cedar, 51 miles.

Union Pacific.—Following the recent purchase of the Victor coal mines in southern Colorado comes the report of the contemplated purchase of the Forbes mines. Several parties of engineers are now in Denver awaiting instructions, and it is rumored that the Union Pacific will build an independent line southward from Pueblo to Apishapa to connect with the southern line.

Recently the Salt Lake Chamber of Commerce passed a resolution requesting the company to extend its line to Pioche, Nev., over the branch graded a few years ago. This week, Secretary Sears, of the Chamber of Commerce, received a letter from President Clark, of the Union Pacific, saying that the present financial condition of the company would not warrant the building of the extension.

Waco, Mooreville & Austin.—The stock subscriptions and grants of right of way being made for the road, it is said, assure its early construction. Edward McCullough and F. E. Rogers, who have gone over the route, recommend the selection of a line to extend from Waco, via Daniels, Mooreville, Durango and Oakers, to a point on the Gulf, Colorado & Santa Fe, between Rogers and Buckholt.

West Virginia & Pennsylvania.—It has been stated several times recently that the Pennsylvania had made an offer to this company for its right of way and surveys, and that negotiations were on foot for that company to build the line under the original charter. This statement has not been denied by officers of either company. The building of this line by the Pennsylvania would give it a route to the upper West Virginia coal fields which are now tributary to the Baltimore & Ohio. The company was chartered in West Virginia some years ago to build a road along the valley of the Monongahela River, and three years ago secured considerable right of way, and made preparations for beginning the work of construction, but failed to do any active work.

Winona & Southwestern.—Mason City, Ia., is offering a bonus equal to five per cent. on the taxable property of the city if this line is extended to that city from Osage, the present terminus. The bonus would amount to about $40,000, approximating $2,000 a mile, as the distance from Osage to Mason City is 22 miles.

Yakima & Pacific Coast.—It is expected that this line, called the South Bend branch of the Northern Pacific, will be turned over to the operating department in April and trains run through to the Pacific coast and South Bend, Wash., from Chehalis, on the Pacific division.

GENERAL RAILROAD NEWS.

Annapolis & Baltimore Short Line.—The United States Court at Baltimore last week appointed Charles A. Coombs, Managing Director of the road, Receiver, in a suit brought by the holders of $500,000 of the company's bonds, who allege that interest had not been paid for a number of years and that the debt is constantly increasing and the earnings are entirely inadequate to pay the present indebtedness.

Atlanta & Florida.—Judge Clark, in the Georgia Supreme Court, at Atlanta, Ga., issued an order on March 11 for the sale of this road at foreclosure. The suit in which the order was issued was brought by the State of Georgia for taxes for the last three years amounting to $13,000, and there are a number of other claims against the road. The Central Trust Company of New York, representing the holders of a majority of the bonds, asked that the sale be made by the United States court instead of the state court. Judge Clark will announce his decision in this matter and set the date for the sale of the road in a later order.

Central Pennsylvania & Western.—The stockholders of the Wilkes-Barre & Western met at Watsontown this week and ratified the agreement of merger with the Turbotville & Williamsport and the Orangeville & Lehigh roads under the above name. The first named is the only one of the three roads which has any portion of its line constructed. It has been operating a line for some years between Watsontown and Orangeville, Pa. Over half the stock of the road is owned in Philadelphia. The Wilkes-Barre & Western will receive bonds of the new company at the rate of 75 cents on the dollar, and stock at the rate of one share for five shares of their present holdings. R. T. McCabe, of 29 Broadway, New York, is President.

Cleveland, Lorain & Wheeling.—The control of the road has been sold by the estate of the late Selah Chamberlain, of Cleveland, O., to a syndicate led by Henry F. Shoemaker and Henry A. Taylor, of New York. Messrs. Shoemaker and Taylor are now in Cleveland in order to complete the transfer. The transfer embraces $4,600,000 preferred stock and $1,000,000 common stock. The road extends from Lorain on Lake Erie south to Bridgeport, O., opposite Wheeling, and its principal traffic arises from handling coal. The same syndicate controls the Cincinnati, Hamilton & Dayton, but it is asserted that the Cleveland, Lorain & Wheeling is not to be leased or consolidated with the first-named road, but it is to be operated independently.

Concord & Montreal.—The Massachusetts Legislative Committee on Railroads has agreed upon a bill to authorize the Boston & Maine or the Boston & Lowell Railroad to lease or purchase the property of the above road. In case the lease be made to the Boston & Lowell, that road has power to assign it to the Boston & Maine.

Grand Trunk.—The Railroad Committee of the Dominion Parliament has passed a bill to ratify an agreement consolidating the following railroad companies into the Grand Trunk Railway Company of Canada, namely: The Jacques Cartier Union, the Montreal & Champlain Junction, the Beauharnois Junction, the Midland Railway of Canada, the Peterborough & Chamong Lake, the Lake Simcoe Junction, the Grand Trunk, Georgian Bay & Lake Erie, the London, Huron & Bruce, the Galt & Guelph, the Brantford, Norfolk & Port Burwell, the Wellington & Grand Bruce, the Waterloo Junction, the North Simcoe, and the Cobourg, Blairton & Marmora Railway & Mining Co. The directors of these companies voted last year to consolidate the lines, which are all operated by the Grand Trunk, by lease.

Great Northern.—The approximate gross earnings for February were as follows:

	1893.	1892.	Inc. or Dec.
St. P., M. & M.	$749,505	$868,518	D. $119,013
E. Ry. of Minn.	66,879	57,906	I. 8,973
Mont. Cen. Ry.	84,254	86,530	D. 2,276
Total for system.	$900,638	$1,013,044	D. $112,406

Approximate gross earnings July 1, 1892, to Feb. 28, 1893:

St. P., M. & M.	$9,700,083	$9,069,954	I. $630,129
E. Ry. of Minn.	1,009,711	884,170	I. 125,541
Mont. Cen. Ry.	802,024	843,901	D. 41,877
Total for system.	$11,511,818	$10,798,025	I. $713,793

Houston, East & West Texas.—Harvey W. Downey was last week appointed Receiver of this road at Houston, Tex., relieving W. G. Howe, who has been Receiver for the last eight years. The road was sold at foreclosure sale last fall to E. S. Jemison, of New York City, and it is expected that the control of the property will be transferred to him and the New York stockholders whom he represents in October next.

Houston & Texas Central.—Justice Jackson, in the United States Supreme Court, has granted a stay of further proceedings in the Circuit Court at New Orleans in the foreclosure suit against this railroad, under which the road was to be sold. The minority stockholders claim that the proceedings are collusive, and designed to turn the property over to the Southern Pacific.

Lehigh Valley.—The Board of Directors this week issued a statement to the stockholders announcing an agreement with the Philadelphia & Reading modifying the rental terms of the lease to the last named company. For two years from March 31, 1893, the rental is reduced from 7 per cent. to 5 per cent. on the capital stock. But should the company's net earnings exceed 10 per cent. in the period of two years, the surplus is to be paid to the Lehigh Valley Company. The directors say that they are thoroughly convinced that the continuation of the lease is to the advantage of both companies, and will secure better results to the Lehigh Valley than if independent action was resorted to.

Louisville, New Albany & Chicago.—The plan providing for the conversion of the present common stock into preferred stock is complete. The present capital of the road is $12,000,000. It is proposed to make $3,000,000 of this stock preferred and at the same time to make the $4,000,000 of additional preferred stock subject to issue from time to time to be offered to shareholders *pro rata*. Stockholders will vote upon the proposition. April 12, 1893. The preferred stock is to be non-accumulative six per cent., and the directors hope to begin paying one per cent. quarterly upon the same after July 1 next.

Missouri Pacific.—The annual report for the year ending Dec. 31, 1892, including the earnings of the St. Louis, Iron Mountain & Southern, gives the following result of operation: Gross earnings from operation, $26,344,788; rentals, dividends, etc., $696,798; total gross earnings, $27,041,037. Operating expenses, $19,238,187; debits to income account for interest, taxes, rentals, etc., $6,999,583; total operating expenses, $26,237,771. Surplus, $803,816. Central Branch Union Pacific Railroad: Gross earnings, $1,319,880; operating expenses, $827,810; net earnings, $494,080.

New York Central & Hudson River.—The directors of the company at a meeting on March 15 decided to increase the capital stock of the company to $100,000,000. The present outstanding issue is $89,428,300, and it is explained that the increase is to be used in payment of improvements and betterments made and to be made by the company, which will cost more than the first estimates. If the increase of capital is authorized at the annual meeting in April, the right to subscribe for new stock at par will be offered to stockholders of record on June 15, payments to be made in three installments, namely, 50 per cent. on July 1, 25 per cent. on Jan. 1, 1894, and 25 per cent. on July 2, 1894.

The formal transfer of the New York & Northern road to the New York Central will not occur until April 1, and the terms under which the company purchase the controlling interest in the road are for the present withheld. The additional capital stock is issued to provide funds for the enlargement of the Grand Central Station and yards in New York City; raising the tracks south of the Harlem River and for erecting the new drawbridge over that river; for new stations and station facilities at Syracuse and other places; increasing the freight facilities at Buffalo where land for this purpose has been purchased to the extent of over $1,000,000; for new freight and passenger cars, and for extending the block system through to Buffalo. The cost of the block signals is given as $1,250,000. No part of the new capital stock is to be used in the purchase of the New York & Northern.

Ohio & Mississippi.—The plan for the consolidation of this company and the Baltimore & Ohio Southwestern was made public this week. The essential features of the plan are the exchange of old securities for new on the following basis: B. & O. Southwestern first mortgage ($11,000,000) to be retired, bond for bond, by new Baltimore & Ohio 4½ per cent. bonds; preferred stock to receive 32½ per cent. in new B. & O. preferred stocks; Ohio & Mississippi preferred stock to pay 5 per cent. cash, and to receive 25 per cent. in new B. & O. first consols, 75 per cent. in new income bonds, 40 per cent. in new 7 per cent. B. & O. preferred stock; Ohio & Mississippi common stock to receive 23 per cent. in junior income bonds and 77 per cent. in new preferred stock. The Baltimore & Ohio takes $10,000,000 of the new common stock, carrying the control. The plan was approved by the London shareholders last month. This consolidation is the sequel to the contest of 1891-'92. In October, 1891, Ohio & Mississippi directors were elected in the Baltimore & Ohio interest, voting trust certificates issued a year before being used to carry the election. The right of the trustees to vote the tied-up stock was contested in the courts by individual shareholders of the Ohio & Mississippi, but the suit was decided in the trustees' favor last April.

Ohio Southern.—The annual report of the company for the year ending Dec. 31, 1892, shows gross earnings, $711,541; operating expenses and taxes, $349,441; net earnings, $362,049; fixed charges, $226,800; surplus, $135,249.

Orange Belt.—The sale of this road occurred at Jacksonville, Fla., last week under the orders of the United States Circuit Court, and according to the reports in the daily papers the property was sold for $150,000 to J. N. Stripling and E. P. Axtell.

Oregon Pacific.—The foreclosure sale of the road has been postponed by the Oregon courts until June 28. It is stated that this action was taken to give the new Receiver an opportunity to make a thorough examination of the company's property and accounts, and to report on the advisability of extending the line east of the Cascade Mountains. It is said that few of the employés have received any pay since April, 1892, and that these claims now amount to $100,000.

Pennsylvania & Northwestern.—A special meeting of the stockholders was held in Philadelphia March 8 for the purpose of voting for or against an increase of the capital stock from $2,000,000 to $2,500,000, only $250,000 of which will be issued at this time, the remainder being held in the treasury. The stock will be offered to the stockholders at par, 90 per cent. of the subscriptions to be payable in cash; the remaining 10 per cent. to be taken from the surplus earnings of the company, which is equivalent to a 10 per cent. stock dividend. The $250,000 thus derived will be used for betterments and improvements.

Peoria, Decatur & Evansville.—A special meeting of the stockholders was to have been held at Peoria, Ill., March 14, to vote upon a plan for consolidating with that company the Chicago & Ohio River road, but one of the objecting stockholders, John Zimmerman, of New York, obtained from Judge Woods, in the United States Circuit Court at Peoria, a temporary injunction restraining the officers of the company from holding the meeting. The case will be argued at Peoria on March 24.

Philadelphia & Reading.—The receivers issued on March 13 their official statement of the current liabilities and assets of both Reading companies as they stood when the receivers were appointed on Feb. 20. It shows $9,867,347 floating debt secured by collaterals and additional amounts due, bringing the total liabilities up to $18,472,828. The assets, including coal materials and all debts due, were $15,779,784 (of which $29,240 was cash), leaving an excess of current liabilities over assets of $2,693,043. The floating debt includes the loan of $3,000,000 due Speyer & Co., and $3,000,000 due the Finance Co. and Philadelphia Warehouse Co. The unpaid wages for January were $748,000. The receivers report 1,107,839 tons of coal on hand, valued at $4 50 a ton, or $4,085,276. The amount due for coal sold is $5,291,829. The following collaterals are placed with the two loans mentioned above: With Speyer & Co., $5,340,000 collateral trust bonds; $200,000 Philadelphia, Harrisburg & Pittsburgh R. R. Co. bonds; $1,000,000 third preference income bonds. With the Finance Co., etc., $1,009,000 third preference income bonds; $440,000 collateral trust bonds; $25,000 general mortgage bonds; also coal on hand and coal accounts. The receivers add the following: The Philadelphia & Reading R. R. Co. is contingently liable as indorser of notes of the Philadelphia, Reading & New England for $350,000, which are collaterally secured by $640,000 first mortgage five per cent. bonds of the Philadelphia, Reading & New England, and also as indorser of the notes of the Mount Carmel & Natalie Railroad for $32,500, which are collaterally secured by $113,000 first mortgage bonds of the Mount Carmel & Natalie Railroad. In connection with 24,036 shares Boston & Maine Railroad stock and 11,000 shares New York & New England stock, there were outstanding $783,000 collateral trust bonds and $1,544,000 third preference income bonds. There is reasonable ground to believe that these collaterals will ultimately revert to the company.

Union Transfer (Memphis).—The officers of this belt line at Memphis, Tenn., deny the reports that the controlling interest in the property has been sold to the Louisville & Nashville, and they state that that could not be done under the terms of the present franchise. They also state that the entire line will probably be completed this year, and if this is done a connection will be made with the Louisville & Nashville and all the other roads entering Memphis.

TRAFFIC.

Traffic Notes.

It is reported that the Mexican Government has abolished the import duty on corn.

The North American Navigation Company started its first vessel from San Francisco for Panama on March 10.

The Seaboard Air Line is said to be making preparations to run a fast vestibule train between Atlanta and New York.

The Norfolk & Western is to put on a through passenger train between Norfolk and Chicago, running by the way of Kenova and Columbus. It will go over the Erie between Marion and Chicago.

The Richmond & Danville is to establish a line of barges on the Mississippi River, between Huntington, the terminus of the Georgia Pacific, on the river, and New Orleans. The court has authorized the receiver to make the necessary expenditures.

The United States District Attorney at Nashville, Tenn., has filed in the Federal Court a bill of complaint of the Interstate Commerce Commission against the Louisvill & Nashville Railroad. The bill alleges that the company has steadily refused, and continues to refuse, to obey an order made by the commission under a decision relative to the discriminations in coal rates to Nashville.

It appears that the circular of the United States Treasury Department making stringent rules about the filing of invoices on goods exported by rail did not go into effect on Feb. 1 as was expected, the numerous protests having led to a postponement; and it is reported that new and easier regulations will now be issued. It is said that much export freight has gone to Mexico, and to Asia by way of the Canadian Pacific, without being included in the government statistics. This defect will be remedied.

Chicago Traffic Matters.

CHICAGO, March 15, 1893.

The lines formerly members of the Transcontinental Association have agreed upon the formation of two rate committees, one to supervise passenger rates and one freight rates, to be in charge of secretaries, which shall cover the territory embraced in the old association. The lines have also agreed upon the adoption of the same rates to Pacific coast points as were recently put in effect by the Northern Pacific, Union Pacific, and Great Northern lines to North Pacific coast points. A comparison of the new and old rates shows reductions as follows in class rates:

From		Classes. 1	2	3	4	5
Missouri River, c. p., Sioux City to Kan. City, inc.; St. Paul, Minneapolis, Duluth, West Superior and c. p.	New	300	260	220	180	160
	Old	350	300	250	200	175
Mississippi river c. p.	New	320	280	230	185	165
	Old	370	320	260	205	180
Chicago, Milwaukee and c. p.	New	340	300	240	190	170
	Old	390	340	270	210	185

Similar reductions are made in the lower classes, and also material reductions in commodity rates west bound.

Chairman Midgley of the Western Freight Association rules that rates on lumber now in effect from St. Paul and Chicago should be readjusted on the basis of 2 cents on St. Paul over Chicago, and recommending the reference of the whole subject to the Lumber Committee.

The Executive Committee to have charge of the Bureau of Information at the World's Fair grounds consists of the following gentlemen: for Western, Northwestern aad Southwesteen lines, George H. Heafford, of the Chicago, Milwaukee & St. Paul road; Eastern lines, O. W. Ruggles, of the Michigan Central; Southern lines, A. H. Hanson, of the Illinois Central; Lake lines, John Singleton, of the Goodrich Transportation Company; committee-man-at-large, P. S. Eustis.

The Atchison, Topeka & Santa Fe, on March 13, filed complaint with Chairman Caldwell, charging the Burlington with manipulating passenger rates and paying large rebates at all important points. The Chicago Great Western is also charged with cutting rates on Detroit business.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines for the week ending March 11, amounted to 83,758 tons, against 81,942 tons during the preceding week, an increase of 1,816 tons, and against 91,455 tons during the corresponding week of 1892. The proportions carried by each road were:

Roads.	W'k to Mar. 11. Tons.	P. c.	W'k to Mar. 4. Tons.	P. c.
Michigan Central	7,460	8.9	10,382	12.7
Wabash	7,464	8.9	7,183	8.8
Lake Shore & Michigan South.	16,597	19.8	16,963	20.7
Pitts., Ft. Wayne & Chicago	10,364	12.4	10,643	13.0
Pitts., Cin., Chicago & St. Louis	9,638	11.5	7,411	9.
Baltimore & Ohio	3,966	4.7	4,479	5.5
Chicago & Grand Trunk	8,115	9.7	8,021	9.8
New York, Chic. & St. Louis	5,570	6.6	6,233	7.6
Chicago & Erie	11,696	14.0	8,179	9.9
C., C., C. & St. Louis	2,888	3.5	2,448	3.0
Totals	83,758	100.0	81,942	100.0

Of the above shipments 11,838 tons were flour, 43,863 tons grain and millstuff, 9,564 tons cured meats, 11,229 tons dressed beef, 1,094 tons butter, 1,355 tons hides, and 4,783 tons lumber. The three Vanderbilt lines carried 35.3 per cent., the two Pennsylvania lines 23.9 per cent.